

```

clear all; close all; clc
load('cam1_4.mat');
load('cam2_4.mat');
load('cam3_4.mat');
numFrames1_4 = size(vidFrames1_4,4);
numFrames2_4= size(vidFrames2_4,4);
numFrames3_4= size(vidFrames3_4,4);

```

```

%cam1-2
data1 = [];
for j = 1:numFrames1_4

%filter for section out other objects.
width = 50;
filter = zeros(480,640);
filter(300-2.6*width:1:300+2.6*width, 350-width:1:350+width) = 1;

X1 = vidFrames1_4(:,:,j);
figure(1)

%subplot(2,1,1),imshow(X1);
level = 0.92;
X1b = im2bw(X1,level);

X1b = double(X1b);
X1b = X1b.*filter;

%subplot(2,1,2),imshow(X1b);

bw = bwlabel(X1b,4);
stats = regionprops(bw, 'BoundingBox', 'Centroid');

hold on

centerX = 0;
centerY = 0;
for object = 1:length(stats)
    %bb = stats(object).BoundingBox;
    bc = stats(object).Centroid;
    centerX = centerX+bc(1);
    centerY = centerY+bc(2);
    %rectangle('Position',bb,'EdgeColor','r','LineWidth',2)
    %plot(bc(1),bc(2), '-m+')
    %a=text(bc(1)+15,bc(2), strcat('X: ', num2str(round(bc(1))), '    Y: ', num2str(round(bc(2)))));
    %set(a, 'FontName', 'Arial', 'FontWeight', 'bold', 'FontSize', 12, 'Color', 'yellow');
end

hold off

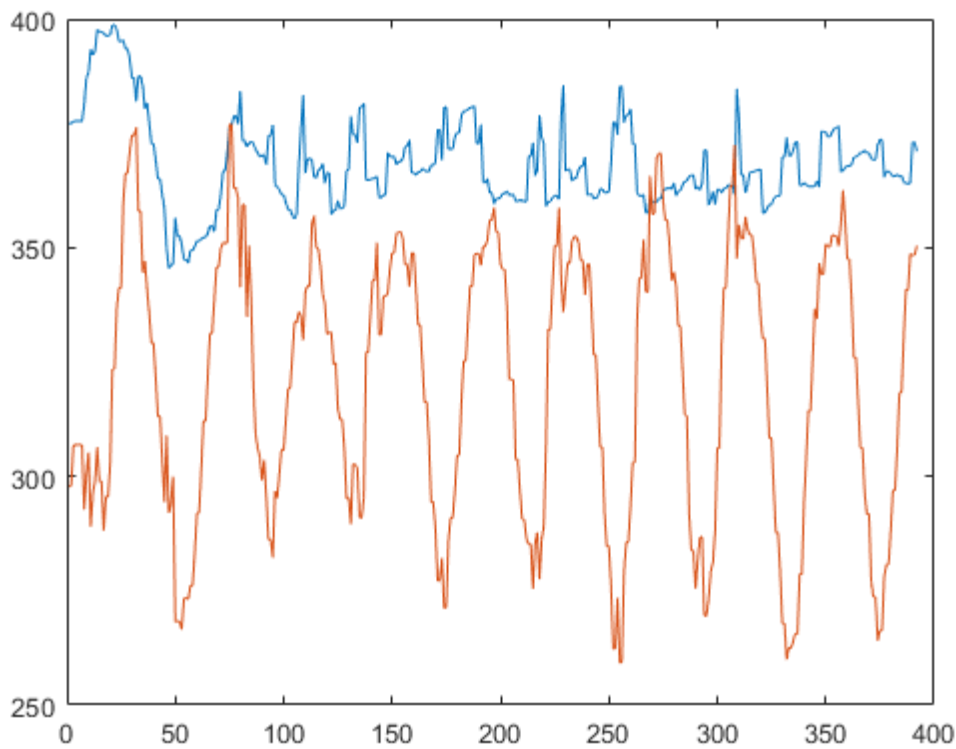
centerX = centerX/length(stats);
centerY = centerY/length(stats);

data1 = [data1;centerX,centerY];

end

plot(data1);

```



cam2-2

```
data2 = [];
for j = 1:numFrames2_4

%filter for section out other objects.
width = 50;
filter = zeros(480,640);
filter(250-3.5*width:1:250+3.5*width, 290-1.6*width:1:290+1.6*width) = 1;

X1 = vidFrames2_4(:,:,j);
figure(1)

%subplot(2,1,1),imshow(X1);
level = 0.92;
X1b = im2bw(X1,level);

X1b = double(X1b);
X1b = X1b.*filter;

%subplot(2,1,2),imshow(X1b);

bw = bwlabel(X1b,4);
stats = regionprops(bw, 'BoundingBox', 'Centroid');

hold on

centerX = 0;
centerY = 0;
for object = 1:length(stats)
    %bb = stats(object).BoundingBox;
    bc = stats(object).Centroid;
    centerX = centerX+bc(1);
    centerY = centerY+bc(2);
    %rectangle('Position',bb,'EdgeColor','r','LineWidth',2)
    %plot(bc(1),bc(2), '-m+')
    %a=text(bc(1)+15,bc(2), strcat('X: ', num2str(round(bc(1)))), '    Y: ', num2str(round(bc(2)))));
    %set(a, 'FontName', 'Arial', 'FontWeight', 'bold', 'FontSize', 12, 'Color', 'yellow');
end
```

```

hold off

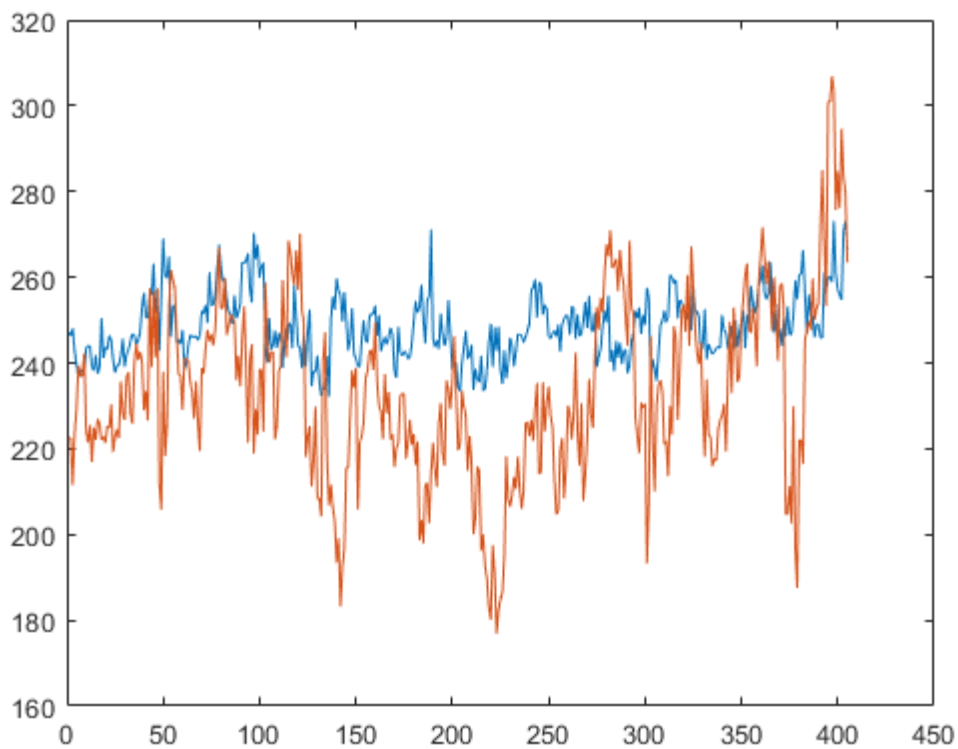
centerX = centerX/length(stats);
centerY = centerY/length(stats);

data2 = [data2;centerX,centerY];

end

plot(data2);

```



cam3-2

```

data3 = [];
for j = 1:numFrames3_4
%filter for section out other objects.
width = 50;
filter = zeros(480,640);
filter(250-4*width:1:250+2.5*width, 360-3*width:1:360+4*width) = 1;

X1 = vidFrames3_4(:,:,j);
figure(1)

%subplot(2,1,1),imshow(X1);
level = 0.90;
X1b = im2bw(X1,level);

X1b = double(X1b);
X1b = X1b.*filter;

%subplot(2,1,2),imshow(X1b);

```

```

bw = bwlabel(X1b,4);
stats = regionprops(bw, 'BoundingBox', 'Centroid');

hold on

centerX = 0;
centerY = 0;
for object = 1:length(stats)
    %bb = stats(object).BoundingBox;
    bc = stats(object).Centroid;
    centerX = centerX+bc(1);
    centerY = centerY+bc(2);
    %rectangle('Position',bb,'EdgeColor','r','LineWidth',2)
    %plot(bc(1),bc(2), '-m+')
    %a=text(bc(1)+15,bc(2), strcat('X: ', num2str(round(bc(1)))), '    Y: ', num2str(round(bc(2)))));
    %set(a, 'FontName', 'Arial', 'FontWeight', 'bold', 'FontSize', 12, 'Color', 'yellow');
end

hold off

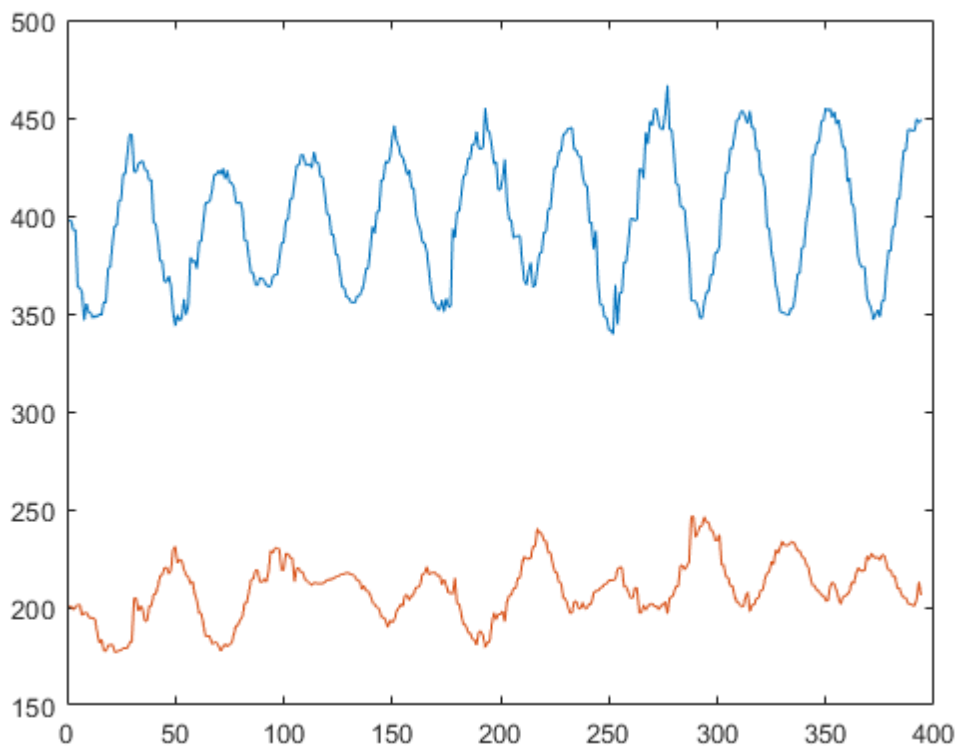
centerX = centerX/length(stats);
centerY = centerY/length(stats);

data3 = [data3;centerX,centerY];

end

plot(data3);

```



```

%clean and format datapoint

```

```

[M,I] = min(data1(1:25,2));
data1 = data1(I:end,:);
[M,I] = min(data2(1:25,2));
data2 = data2(I:end,:);
[M,I] = min(data3(1:25,1));

```

```

data3 = data3(1:end,:);
data3vter = [];
data3vter(:,1) = data3(:,2);
data3vter(:,2) = data3(:,1);

```

```

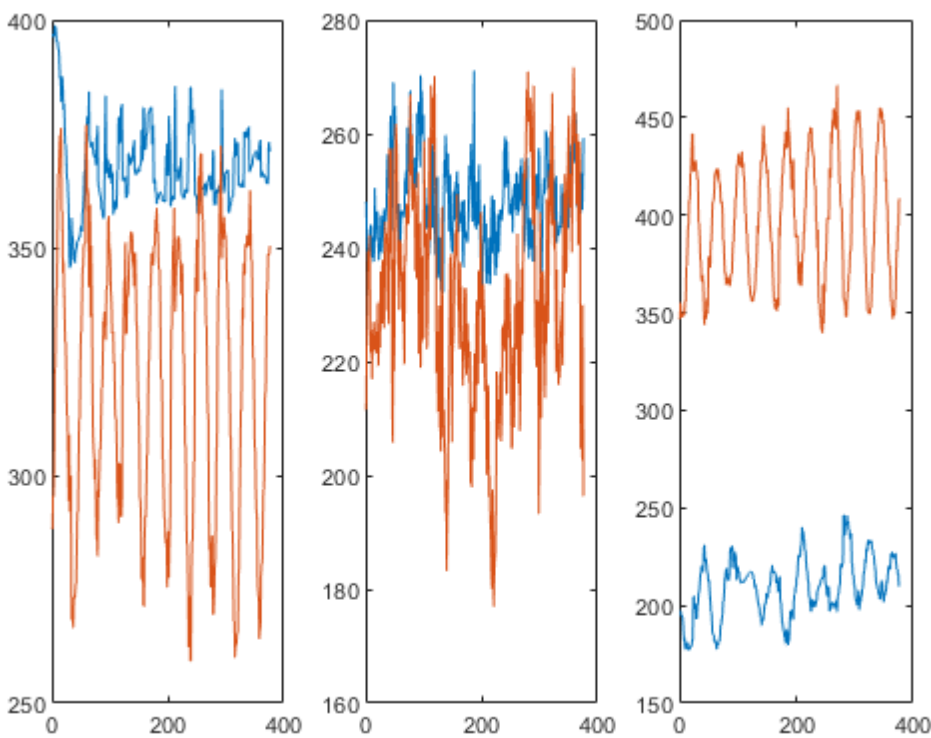
%clean and format datapoint
data2 = data2(1:length(data1), :);
data3vter = data3vter(1:length(data1), :);

```

```

figure(5)
subplot(1,3,1), plot(data1);
subplot(1,3,2), plot(data2);
subplot(1,3,3), plot(data3vter);

```



```

dataAll = [data1';data2';data3vter'];

```

```

[m,n]=size(dataAll);
mn=mean(dataAll,2);
dataAll=dataAll-repmat(mn,1,n);

```

```

[u,s,v]=svd(dataAll'/sqrt(n-1));
lambda=diag(s).^2;
Y= dataAll' * v;
sig=diag(s);

```

```

figure()
plot(1:6, lambda/sum(lambda), 'rx', 'Linewidth', 1);
title("Test 4: Level of each Diagonal Variance");
xlabel("Diagonal Variances");
ylabel("Level");

```

```

figure()
subplot(2,1,1)
plot(1:376, dataAll(2,:), "r", 1:376, dataAll(1,:), "blue", 'Linewidth', 1)
ylabel("Displacement (pixels)");
xlabel("Time (frames)");

```

```

title("Test 4, Cam 1: Original displacement across Z axis and XY-plane");
legend("Z", "XY");

subplot(2,1,2)
plot(1:376, Y(:,1), 'r', 'Linewidth', 1)
ylabel("Displacement (pixels)");
xlabel("Time (frames)");
title("Test 4: Displacement of first principal component directions");
saveas(gcf, 'pcatest4.png')

```

