function pos = trackingFly(videoPath)

%track the walking path of a fruit fly

% videoPath: the path of the video to be analyzed

% pos: a structure containing the coordinates of the walking path

% Author: Xing Yang (yangx82@hotmail.com)

% Date: 04/11/2015

vobj = VideoReader(videoPath);

nFrames = vobj.NumberOfFrames;

Fs = vobj.FrameRate;

height = vobj.Height;

width = vobj.Width;

grayVid = zeros(height,width);

 vidFrame = read(vobj, 1);

 vidFrame = rgb2gray(vidFrame);

 figure; imshow(vidFrame)

title(‘Please select the area for analysis’)

 bw = roipoly; % to select the area for analysis

for iFrame = 1:Fs:nFrames

 vidFrame = read(vobj, iFrame);

 vidFrame = double(rgb2gray(vidFrame));

 vidFrame = vidFrame.\*bw;

 grayVid = grayVid + vidFrame;

end

vidMean = grayVid/(length(1:Fs:nFrames));

vidMean = (vidMean-min(vidMean(:)))/(max(vidMean(:))-min(vidMean(:)));

pos.x = zeros(nFrames,1);

pos.y = zeros(nFrames,1);

for iFrame = 1:nFrames

 vidFrame = read(vobj, iFrame);

 colorVidFrame = vidFrame;

 vidFrame = double(rgb2gray(vidFrame));

 vidFrame = vidFrame.\*bw;

 vidFrame = (vidFrame-min(vidFrame(:)))/(max(vidFrame(:))-min(vidFrame(:)));

 dFrame = vidFrame - vidMean;

 bwFrame = dFrame>.1;

 bwFrame = bwareaopen(bwFrame,15);

 bwFrame = bwmorph(bwFrame,'close');

 bwFrame = bwmorph(bwFrame,'dilate');

 bwFrame = bwmorph(bwFrame,'close');

 bwFrame = bwareaopen(bwFrame,50);

 [x,y] = find(bwFrame);

 pos.x(iFrame) = mean(x);

 pos.y(iFrame) = mean(y);

 bwBoundary = bwmorph(bwFrame,'remove');

 colorVidFrame(:,:,1) = uint8(double(colorVidFrame(:,:,1)) + (255\*bwBoundary));

 imshow(colorVidFrame)

 pause(0.1/Fs)

 end

figure;

plot(pos.x,pos.y)