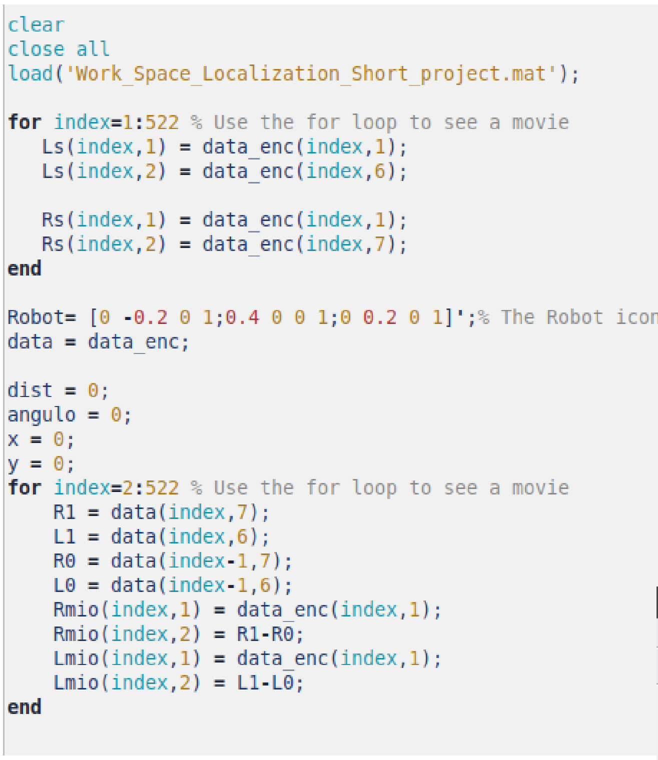
ToDo Localization Robot

1. Pose estimated



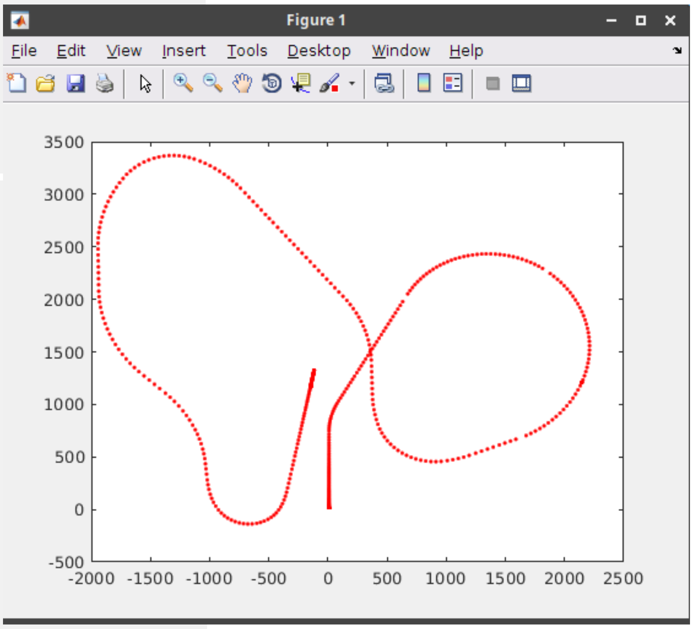
```
clear
close all
load('Work_Space_Localization_Short_project.mat');

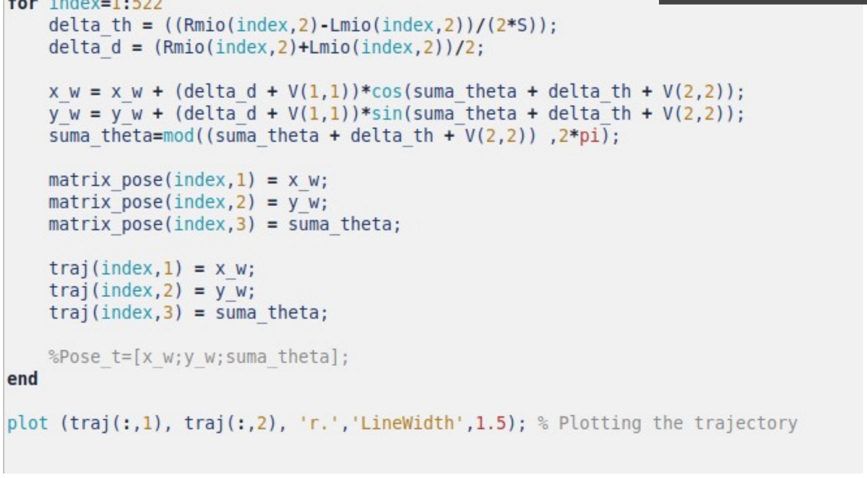
for index=1:522 % Use the for loop to see a movie
   Ls(index,1) = data_enc(index,1);
   Ls(index,2) = data_enc(index,6);

   Rs(index,1) = data_enc(index,1);
   Rs(index,2) = data_enc(index,7);
end

Robot= [0 -0.2 0 1;0.4 0 0 1;0 0.2 0 1]';% The Robot icon is a triangle
data = data_enc;

dist = 0;
angulo = 0;
x = 0;
y = 0;
for index=2:522 % Use the for loop to see a movie
    R1 = data(index,7);
    L1 = data(index,6);
    R0 = data(index-1,7);
    L0 = data(index-1,6);
    Rmio(index,1) = data_enc(index,1);
    Rmio(index,2) = R1-R0;
    Lmio(index,1) = data_enc(index,1);
    Lmio(index,2) = L1-L0;
end
```





```
%Encontrando la trayectoria
%Inicializamos

ts=0.02;
S = 243/2;

IC = [8.65,17.2,-pi/2];
x_ini=IC(1);
y_ini=IC(2);
theta_ini=IC(3);

x_w=x_ini;
y_w=y_ini;
suma_theta=-theta_ini;

ProcNoiseD = [0.000100000000000000];
ProcNoiseTheta = [1.00000000000000e-06];
V=[ProcNoiseD 0;0 ProcNoiseTheta];

for index=1:522
    delta_th = ((Rmio(index,2)-Lmio(index,2))/(2*S));
    delta_d = (Rmio(index,2)+Lmio(index,2))/2;

    x_w = x_w + (delta_d + V(1,1))*cos(suma_theta + delta_th + V(2,2));
    y_w = y_w + (delta_d + V(1,1))*sin(suma_theta + delta_th + V(2,2));
    suma_theta=mod((suma_theta + delta_th + V(2,2)) ,2*pi);

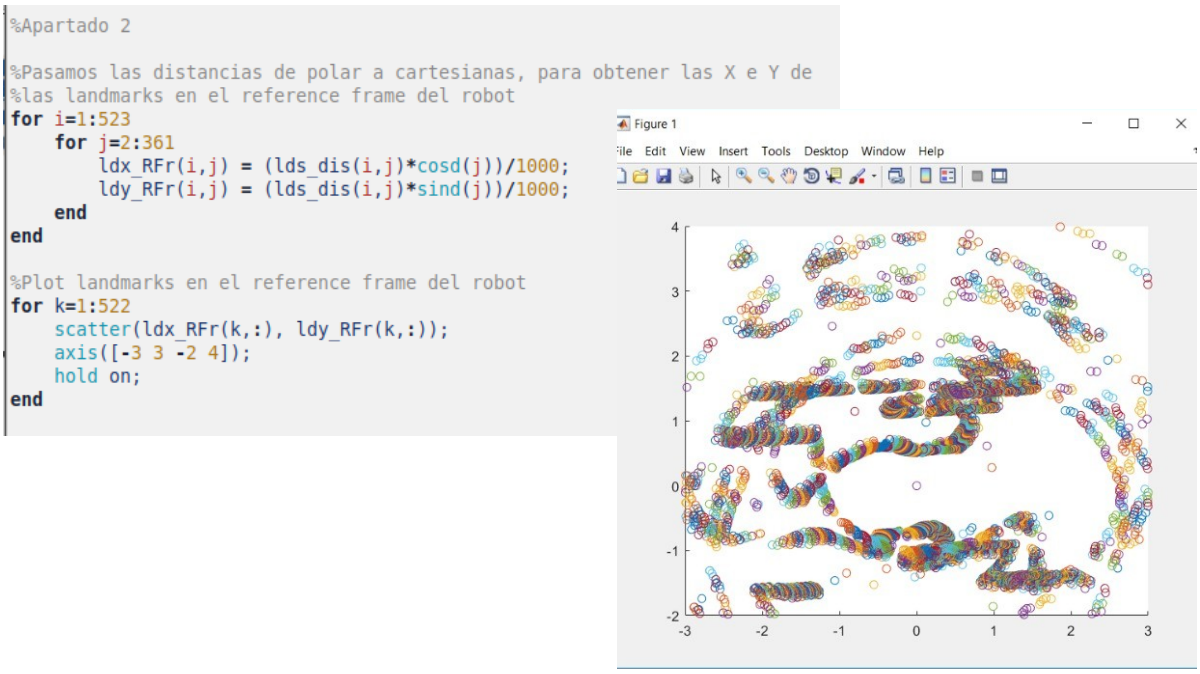
    matrix_pose(index,1) = x_w;
    matrix_pose(index,2) = y_w;
    matrix_pose(index,3) = suma_theta;

    traj(index,1) = x_w;
    traj(index,2) = y_w;
    traj(index,3) = suma_theta;

    %Pose_t=[x_w;y_w;suma_theta];
end

plot (traj(:,1), traj(:,2), 'r.','LineWidth',1.5); % Plotting the trajectory
```

2. Polar to cartesian

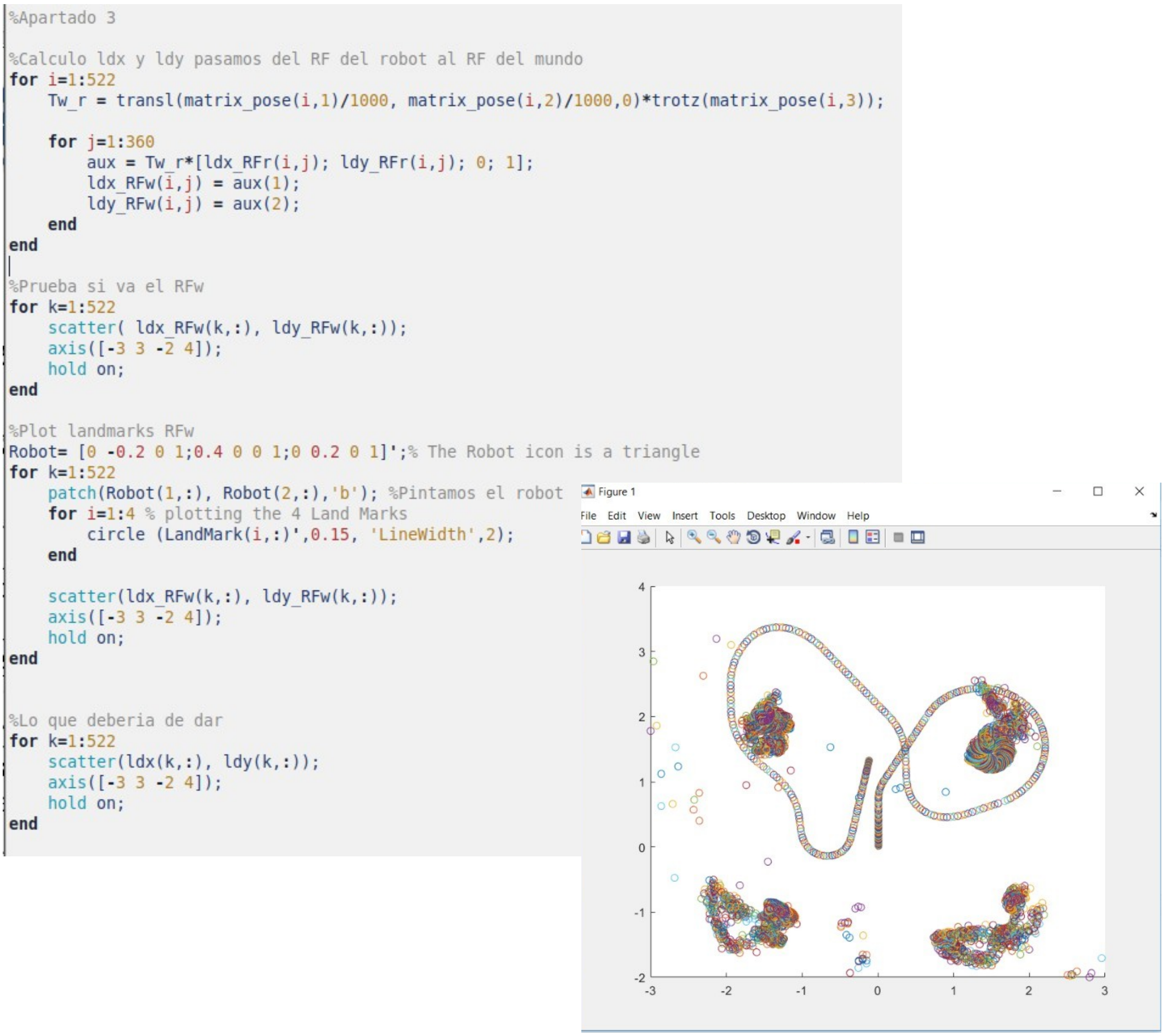


```
%Apartado 2

%Pasamos las distancias de polar a cartesianas, para obtener las X e Y de
%las landmarks en el reference frame del robot
for i=1:523
    for j=2:361
        ldx_RFr(i,j) = (lds_dis(i,j)*cosd(j))/1000;
        ldy_RFr(i,j) = (lds_dis(i,j)*sind(j))/1000;
    end
end

%Plot landmarks en el reference frame del robot
for k=1:522
    scatter(ldx_RFr(k,:), ldy_RFr(k,:));
    axis([-3 3 -2 4]);
    hold on;
end
```

3. Robot to world



```
%Apartado 3

%Calculo ldx y ldy pasamos del RF del robot al RF del mundo
for i=1:522
    Tw_r = transl(matrix_pose(i,1)/1000, matrix_pose(i,2)/1000,0)*trotz(matrix_pose(i,3));

    for j=1:360
        aux = Tw_r*[ldx_RFr(i,j); ldy_RFr(i,j); 0; 1];
        ldx_RFw(i,j) = aux(1);
        ldy_RFw(i,j) = aux(2);
    end
end

%Prueba si va el RFw
for k=1:522
    scatter( ldx_RFw(k,:), ldy_RFw(k,:));
    axis([-3 3 -2 4]);
    hold on;
end

%Plot landmarks RFw
Robot= [0 -0.2 0 1;0.4 0 0 1;0 0.2 0 1]';% The Robot icon is a triangle
for k=1:522
    patch(Robot(1,:), Robot(2,:),'b'); %Pintamos el robot
    for i=1:4 % plotting the 4 Land Marks
        circle (LandMark(i,:)',0.15, 'LineWidth',2);
    end

    scatter(ldx_RFw(k,:), ldy_RFw(k,:));
    axis([-3 3 -2 4]);
    hold on;
end


%Lo que deberia de dar
for k=1:522
    scatter(ldx(k,:), ldy(k,:));
    axis([-3 3 -2 4]);
    hold on;
end
```

4. Associated Land Mark

```
%Apartado 4

%Filtro de las landmarks, eliminamos las que no corresponden a un landmark
%real
xcount_u_r = 0;
xcount_d_r = 0;
xcount_u_l = 0;
xcount_d_l = 0;

ycount_u_r = 0;
ycount_d_r = 0;
ycount_u_l = 0;
ycount_d_l = 0;

xsum_u_r = 0;
xsum_d_r = 0;
xsum_u_l = 0;
xsum_d_l = 0;

ysum_u_r = 0;
ysum_d_r = 0;
ysum_u_l = 0;
ysum_d_l = 0;

for i=1:522
    for j=1:360
        %Arriba derecha (ur)
        if (ldx_RFw(i,j) > (0.5) && ldx_RFw(i,j) < (2.5)) && (ldy_RFw(i,j) > (0.5) && ldy_RFw(i,j) < (2.5))
            xcount_u_r = xcount_u_r + 1;
            xsum_u_r = xsum_u_r + ldx_RFw(i,j);

            ycount_u_r = ycount_u_r + 1;
            ysum_u_r = ysum_u_r + ldy_RFw(i,j);

        %Abajo derecha (dr)
        elseif (ldx_RFw(i,j) > (0.5) && ldx_RFw(i,j) < (2.5)) && (ldy_RFw(i,j) < (-0.5) && ldy_RFw(i,j) > (-2.5))
            xcount_d_r = xcount_d_r + 1;
            xsum_d_r = xsum_d_r + ldx_RFw(i,j);

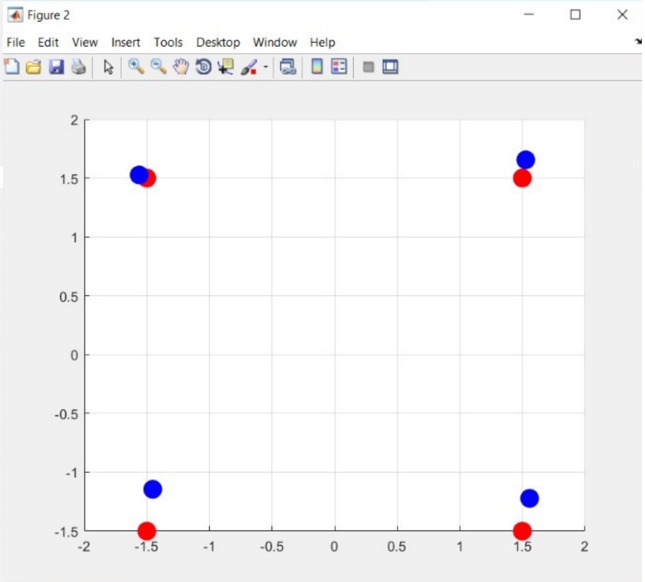
            ycount_d_r = ycount_d_r + 1;
            ysum_d_r = ysum_d_r + ldy_RFw(i,j);

        %Abajo izquierda (dl)
        elseif (ldx_RFw(i,j) < (-0.5) && ldx_RFw(i,j) > (-2.5)) && (ldy_RFw(i,j) < (-0.5) && ldy_RFw(i,j) > (-2.5))
            xcount_d_l = xcount_d_l + 1;
            xsum_d_l = xsum_d_l + ldx_RFw(i,j);

            ycount_d_l = ycount_d_l + 1;
            ysum_d_l = ysum_d_l + ldy_RFw(i,j);

        %Arriba izquierda (ul)
        elseif (ldx_RFw(i,j) < (-0.5) && ldx_RFw(i,j) > (-2.5)) && (ldy_RFw(i,j) > (0.5) && ldy_RFw(i,j) < (2.5))
            xcount_u_l = xcount_u_l + 1;
            xsum_u_l = xsum_u_l + ldx_RFw(i,j);

            ycount_u_l = ycount_u_l + 1;
            ysum_u_l = ysum_u_l + ldy_RFw(i,j);
        end
    end
end
```



```
%Medias
% X
landmarks_nuestras(1,1) = xsum_u_r/xcount_u_r;
landmarks_nuestras(1,2) = xsum_d_r/xcount_d_r;
landmarks_nuestras(1,3) = xsum_u_l/xcount_u_l;
landmarks_nuestras(1,4) = xsum_d_l/xcount_d_l;
% Y
landmarks_nuestras(2,1) = ysum_u_r/ycount_u_r;
landmarks_nuestras(2,2) = ysum_d_r/ycount_d_r;
landmarks_nuestras(2,3) = ysum_u_l/ycount_u_l;
landmarks_nuestras(2,4) = ysum_d_l/ycount_d_l;

%Landmarks originales
LandMark = [  1.5,1.5; -1.5,1.5; -1.5,-1.5;  1.5, -1.5]';
figure
axis ([-2 2 -2 2])
scatter(LandMark(1,:),LandMark(2,:),200, 'r','filled');
grid on;
hold on;
%Plot landmarks nuestras en FR world
scatter(landmarks_nuestras(1,:),landmarks_nuestras(2,:),200, 'b','filled');
```

5. Similarity Transform

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%Apartado 5

%Build Matrix A
A = [];
for i=1:size( LandMark , 2)
    A = [A;[ LandMark(1,i), LandMark(2,i),1,0]];
    A = [A;[ LandMark(2,i),-LandMark(1,i),0,1]];
end

%Build Matrix B
B = [];
for i=1:size( landmarks_nuestras , 2)
    B = [B;  [landmarks_nuestras(1,i),  landmarks_nuestras(2,i)]];
end

%Compute tx ty i tita
X = inv((A'*A))*A'*B;
Tx_ST = X(3);
Ty_ST= X(4);
alpha_ST = atan2(X(2),X(1))*180/pi;

%Rotamos y transladamos nuestras landmarks
matriz_correccion = transl(Tx_ST,Ty_ST,0)*trotz(alpha_ST);

landmarks_corregidas(1,:) = landmarks_nuestras(1,:)*matriz_correccion;
landmarks_corregidas(2,:) = landmarks_nuestras(2,:)*matriz_correccion;

%Landmarks originales
LandMark = [  1.5,1.5; -1.5,1.5; -1.5,-1.5;  1.5, -1.5]';
figure
axis ([-2 2 -2 2])
scatter(LandMark(1,:),LandMark(2,:),200, 'r','filled');
grid on;
hold on;
%Plot landmarks nuestras en FR world corregidas
scatter(landmarks_corregidas(1,:),landmarks_corregidas(2,:),200, 'b','filled');
```