Introduction to Data Science Report

People tracking by Mdog

Wei-Zhi Chen & Po-Jui Huang
Department of Mathematics
National Central University

Abstract—In the midterm this semester, we use turtlebot to identify the ball and the box, and also, we learned how to identify whether a group of lidar data is a human leg or not.

Since we have this background, we want to go further, including the ROS system, the thing we does not know well, to make a robot that can identify human leg, then track and follow this target.

I. INTRODUCTION

First of all, we would like to introduce the robot(s) and the system we have used.

(a) Mdog:

A dog bionic designed robot created from MRL (Math and Robotics Lab), NCU.

Includes 360-degree lidar (0.5 degree per calibration), RGBD camera, 9-axis IMU sensors

Its motion is controlled by 12 motors, 3 motors per leg.

We had planned to use the lidar and the camera to train the models we want, such as human leg identifier, but because of some technical problem (and some hardware problem), we only use the lidar sensor to collect the data.

(b) ROS:

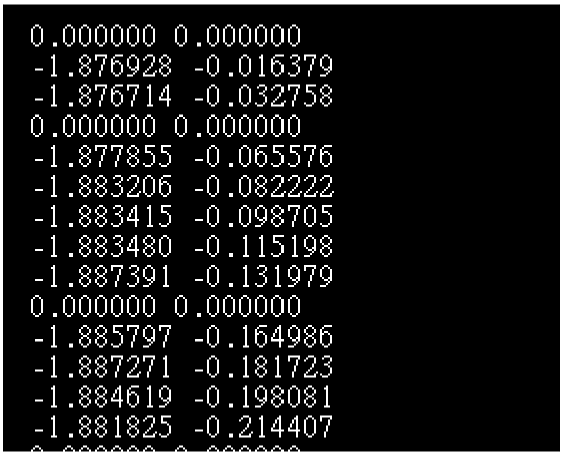
The ROS (Robot Operating System) framework is to control robots. The robots of MRL could all be ordered by ROS.

We tell the Mdog where to go or how to move when it detected a human leg vis this system.

We separate this project into several parts: Collecting data, labeling, segmentation, training the Adaboost model, ROS system implementation.

(a) Collecting Data:

We using the 360° Lidar to collect the data about our feet, which looks like bellow:

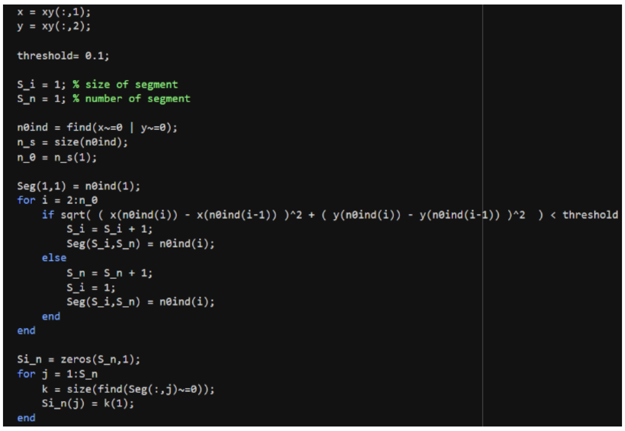


```
0.000000 0.000000
 -1.876928 -0.016379
 -1.876714 -0.032758
0.000000 0.000000
 -1.877855 -0.065576
 -1.883206 -0.082222
 -1.883415 -0.098705
 -1.883480 -0.115198
 -1.887391 -0.131979
0.000000 0.000000
 -1.885797 -0.164986
 -1.887271 -0.181723
 -1.884619 -0.198081
 -1.881825 -0.214407
```

As you can see, we will obtain a group of data containing x and y coordinates, note that the original laser data is in polar coordinates, we had transformed them into xy coordinates before we extract the data.

(b) Segmentation:

Now we have a group of laser data, which includes polar coordinates (r, theta) or xy coordinates (x, y). We separate these laser data into line segments, the source code is below:



```
x = xy(:,1);
y = xy(:,2);

threshold= 0.1;

S_i = 1; % size of segment
S_n = 1; % number of segment

n0ind = find(x~=0 | y~=0);
n_s = size(n0ind);
n_0 = n_s(1);

Seg(1,1) = n0ind(1);
for i = 2:n_0
    if sqrt( ( x(n0ind(i)) - x(n0ind(i-1)) )^2 + ( y(n0ind(i)) - y(n0ind(i-1)) )^2  ) < threshold
        S_i = S_i + 1;
        Seg(S_i,S_n) = n0ind(i);
    else
        S_n = S_n + 1;
        S_i = 1;
        Seg(S_i,S_n) = n0ind(i);
    end
end

Si_n = zeros(S_n,1);
for j = 1:S_n
    k = size(find(Seg(:,j)~=0));
    Si_n(j) = k(1);
end
```

The input of this function is a 2×n matrix, the 1st

The output of this function will be a matrix, and the