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% % ECPE 155 Autonomous Robotics
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```

Worksheet 5 (a)

```
% Write a script to find the line in featureOne (mat, csv)
% using our regression equation. The data is in [x, y] form.

% Read in values
load featureOne;
figure
plot(dataPoints,'.')
hold on

x = dataPoints(:,1);
y = dataPoints(:,2);
nSize = length(x);

X = ones(100,2);
X(:,2) = dataPoints(:,1);
Y = dataPoints(:,2);
X_transpose = X.';
w = (X_transpose*X)^(-1)*X_transpose*Y;
S = X*w-Y;
S_mag_L2_norm = (abs(S)).^2;

n = 1:1:100;
y_eqn = w(2)*n + w(1);
plot(n,y_eqn);

str2Send = 'The line is y = %fx + %f based on regression equation.';
str = sprintf(str2Send,w(2),w(1))

% As a check we could also filter out a couple points to use in our
 own
% fitted line.
% Suppose we want points with a distance error (di) of approximately
% 32/1000th of a cm or less. Our fitted line will run through these
 points.
fit_found = 1;
for n=1:1:nSize;

    if(S_mag_L2_norm(n) <= 0.0032)
        xfit([n;1]) = x([n;1]);
        yfit([n;1]) = y([n;1]);
        fit_found = fit_found + 1;
    end

    if(fit_found > 1)
        break;
    end
```

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end

end_point_fit_y = length(yfit);
end_point_fit_x = length(xfit);

% Determine equations for lines
m = (yfit(end_point_fit_y)-yfit(1))/(xfit(end_point_fit_x)-xfit(1));
b = yfit(1) - m*xfit(1);
n = 1:1:100;
y = m*n + b;

str2Send = 'The line is y = %fx + %f based on sample points chosen.';
str = sprintf(str2Send,m,b)

plot(n,y)
title('Feature Extraction: Worksheet 5 -
 featureOne','interpreter','latex');
xlabel('(n)','interpreter','latex');
ylabel('(y)','interpreter','latex');
legend('matlabs goofiness','raw data','fitted-line using
 regression','fitted-line using a couple points');
hold off
```
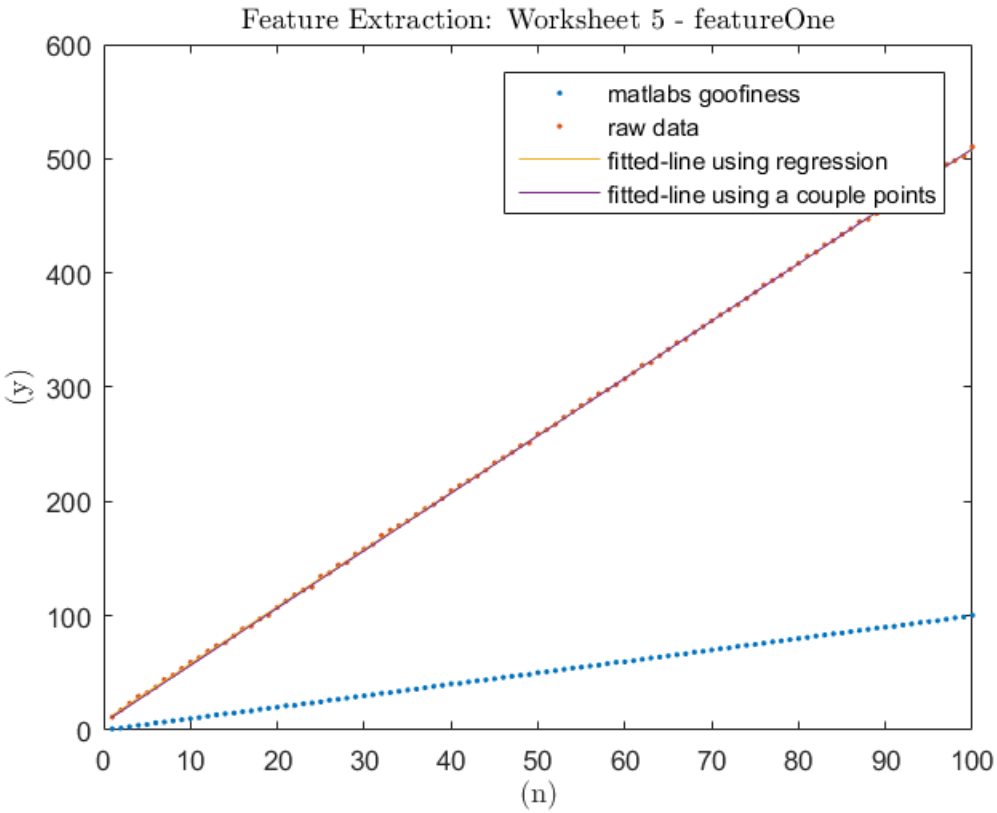

```
str =

The line is y = 5.002515x + 7.958876 based on regression equation.


str =

The line is y = 5.024392x + 6.354224 based on sample points chosen.
```



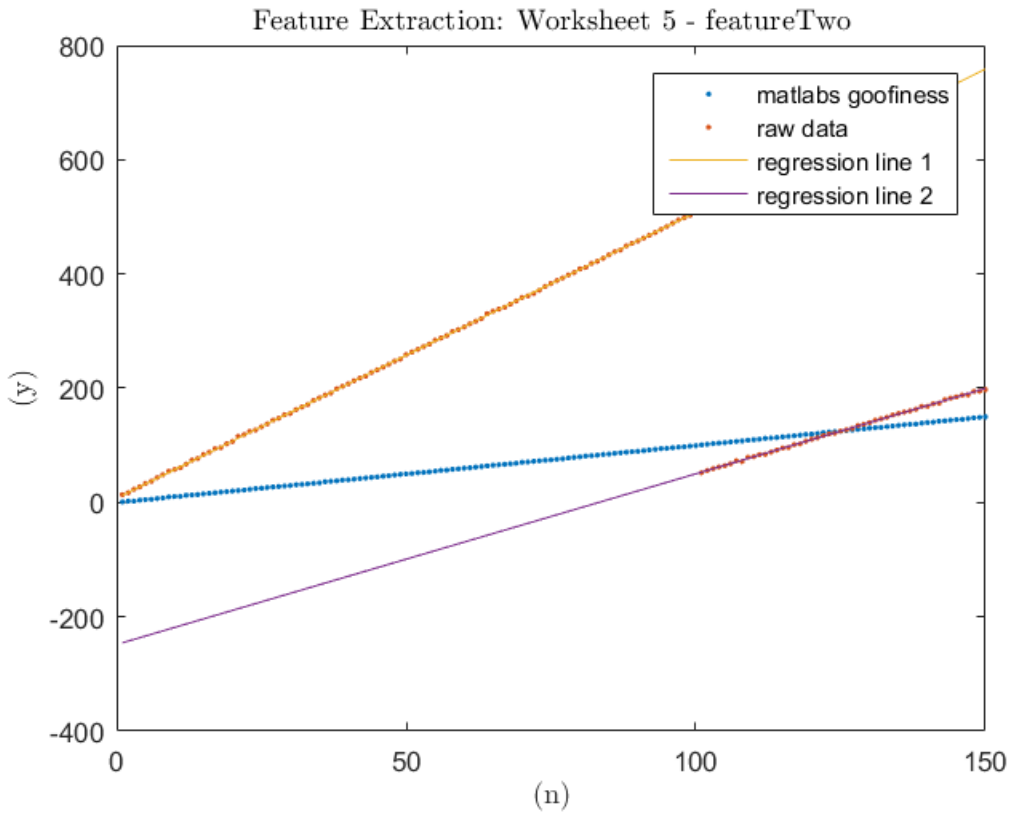
Worksheet 5 (b)

```
% Using either Split-And-Merge or RANSAC, write a script to determine
 the
% number of lines in featureTwo (mat, csv). Again, the data is in [x,
 y]
% form. Use your script from Step 2 to find the equations of each
% line discovered.

% Split and merge - Given a set of measurements how many lines and
 which
% measurements belong to which line? Segment the data into line groups
 and
% then use regression.

% Read in values
load featureTwo;
figure
plot(dataPoints,'.')
hold on

x = dataPoints(:,1);
y = dataPoints(:,2);
nSize = length(dataPoints);
```

```
% Based on plot, split data off at element 101.
Xi = ones(nSize,2);
Xi(1:nSize,2) = dataPoints(1:nSize,1);
Yi = dataPoints(1:nSize,2);
Xi_transpose = Xi.';
wi = (Xi_transpose*Xi)^(-1)*Xi_transpose*Yi;
Si = Xi*wi-Yi;
Si_mag_L2_norm = (abs(Si)).^2;

% Search for discontinuity, maxDp
% Save index value
maxDp = Si_mag_L2_norm(1);
indexMax = 1;
for n = 1:1:nSize

    if(Si_mag_L2_norm(n) > maxDp)
        maxDp = Si_mag_L2_norm(n);
        indexMax = n;
    end

end

% Split at discontinuity point
Xi1 = ones(indexMax,2);
Xi1(1:indexMax,2) = dataPoints(1:indexMax,1);
Yi1 = dataPoints(1:indexMax,2);
Xi1_transpose = Xi1.';
wi1 = (Xi1_transpose*Xi1)^(-1)*Xi1_transpose*Yi1;
Si1 = Xi1*wi1-Yi1;
Si1_mag_L2_norm = (abs(Si1)).^2;

indexMax2 = (nSize-(nSize-indexMax)+1);
nSize2 = (nSize-indexMax);
Xi2 = ones(nSize2,2);
Xi2(1:nSize2,2) = dataPoints(indexMax2:nSize,1);
Yi2 = ones(nSize,1);
Yi2 = dataPoints(indexMax2:nSize,2);
Xi2_transpose = Xi2.';
wi2 = (Xi2_transpose*Xi2)^(-1)*Xi2_transpose*Yi2;
Si2 = Xi2*wi2-Yi2;
Si2_mag_L2_norm = (abs(Si2)).^2;

% Equations for lines
str2Send = 'The line is y = %fx + %f for Si1';
str = sprintf(str2Send,wi1(2),wi1(1))
str2Send = 'The line is y = %fx + %f for Si2';
str = sprintf(str2Send,wi2(2),wi2(1))

n = 1:1:nSize;
y1_eqn = wi1(2)*n + wi1(1);
y2_eqn = wi2(2)*n + wi2(1);
plot(n,y1_eqn)
plot(n,y2_eqn)
```

```
title('Feature Extraction: Worksheet 5 -
 featureTwo','interpreter','latex');
xlabel('(n)','interpreter','latex');
ylabel('(y)','interpreter','latex');
legend('matlabs goofiness','raw data','regression line 1','regression
 line 2');

hold off
```

```
str =

The line is y = 5.008157x + 7.392085 for Si1


str =

The line is y = 2.988005x + -248.509951 for Si2
```



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