MATLAB-Programming

Regression (i.e., Linear, Power and Saturation growth rate models)

By Mojahed Nour– Dec 15, 2019

CONTENTS

Regression

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What Is Regression?

Regression is a statistical method used in finance, investing, and other disciplines that attempts to determine the strength and character of the relationship between one dependent variable (usually denoted by Y) and a series of other variables (known as independent variables).

What is the task about ?

I . Writing a MATLAB function that accepts n values of x and y, perform Linear Regression and returns values of r2 and, the model parameters a and $a0$.
The *function* should accept 2 parameters AND It should return 3 values.

II. Writing another MATLAB function that accepts n values of x and y (provided as arrays), checks for Linear, Power and Saturation growth rate models, and estimate the values of parameters a and $a0$ (or α and β, whichever is applicable).

The technique & code

The mechanism of the Regression functions *:*

In all three methods,

- The 2nd function should use the 1st function developed in part (I) to perform the linear regression part.

- The 2nd function should plot the given data and the three models (one linear and two non-linear) on the same graph (use distinct colors/shades of lines to differentiate).

- The 2nd function should return a number from 1-3 indicating the model with the best fit, its r2, and the estimated values of parameters.

The code

Pseudocode of a MATLAB function that calculates the Regression Parameters:

```matlab
function[RANK,r2,a0,a1]=regression(x,y)
[rlin2,alin0,alin1]=LinearRegression2(x,y);%%firstly for linear
EQ1=@(X) alin0+X*alin1;

[rpow2,a00pow,a1pow]=LinearRegression2(log10(x),log10(y));%% for nonlinear (Power)
a0pow=10^(a00pow);
EQ2=@(x) a0pow*x.^(a1pow);

[rsat,a0sat,a1sat]=LinearRegression2(1./x,1./y);%% for nonlinear ( saturation)
alpha=1/a1sat;
beta=alpha*a0sat;
EQ3=@(x) alpha*x./(beta+x);

XALL=linspace(min(x),max(x));
plot(XALL,EQ1(XALL),XALL,EQ2(XALL),':',XALL,EQ3(XALL),'--',x,y,'o');
legend('Linear','Power','Saturation','data points');
if (rlin2>rpow2)
RANK=1;
r2=rllin2;
a0=alin0;
a1=alin1;

end
if (rpow2>rsat)
 RANK=2;
r2=rsat;
a0=a0sat;
a1=a1sat; end
```

```matlab
if (rsat>rpow2)
 RANK=3;
r2=rsat;
a0=alpha;
a1=beta;

end
end

function [r2,a0,a1]=LinearRegression2(x,y)


n = length(x);
a0 = (mean(y)*sum(x.^2)-mean(x)*sum(x.*y))/(sum(x.^2)-n*mean(x)^2);
a1 = (sum(x.*y)-mean(x)*sum(y))/(sum(x.^2)-n*mean(x)^2);
st=sum((y - mean(y)).^2);
sr=sum((y-a0-x*a1).^2);
r2=(st-sr)/st;

end
```
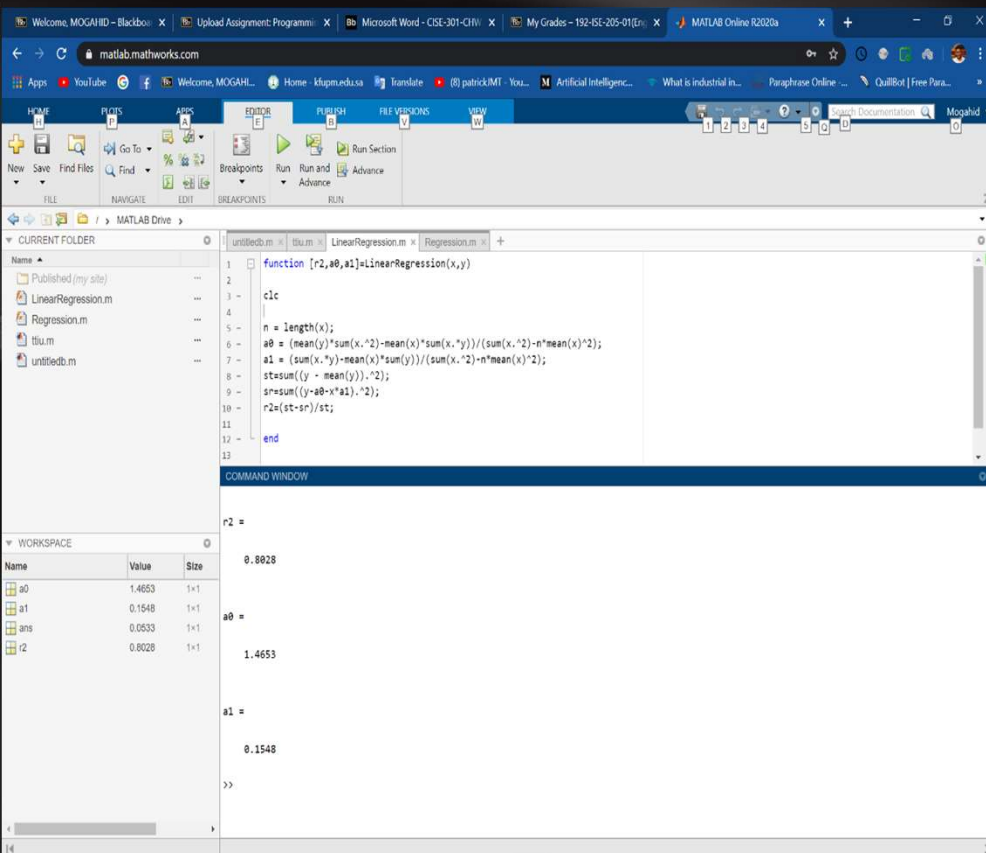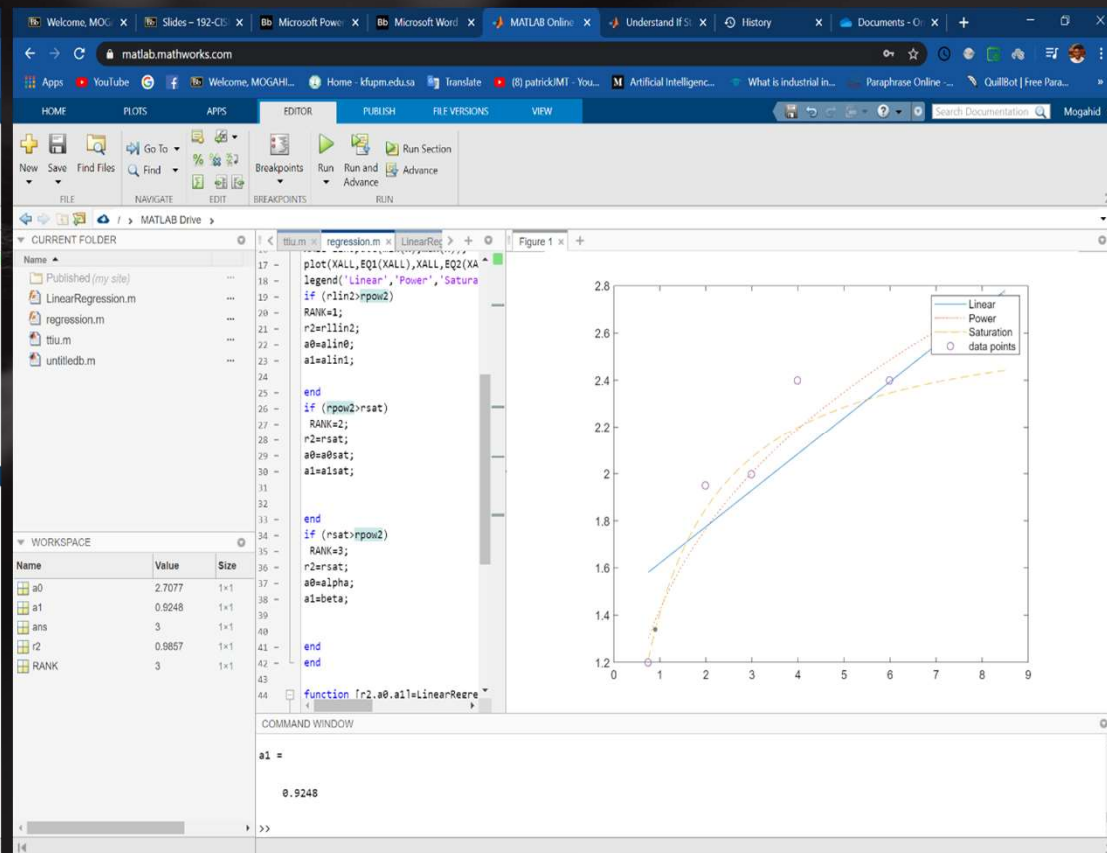
The output samples

1st part (linear regression function) output

2nd part (one linear and two non-linear) output

THANK YOU

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You are Welcome To Contact Me

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