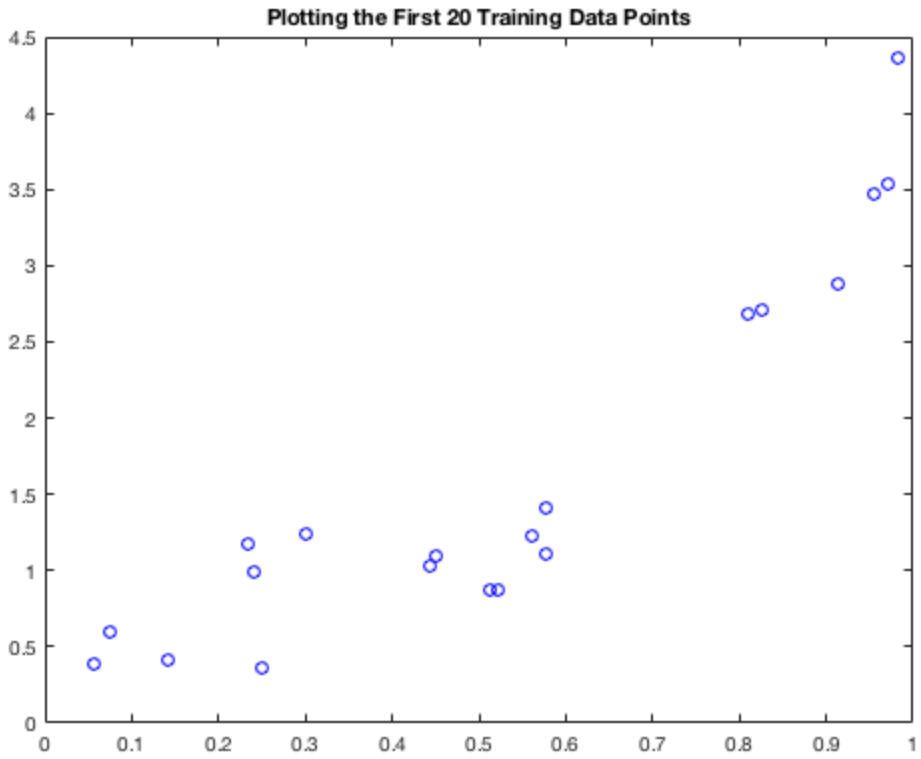
Table of Contents

Set up Data

```
clear
mTrain=load('data/mTrainData.txt');
mTest = load('data/mTestData.txt');

Xte=mTest(:,1); Yte=mTest (:,2);
Xtr=mTrain(:,1); Ytr=mTrain (:,2);
```

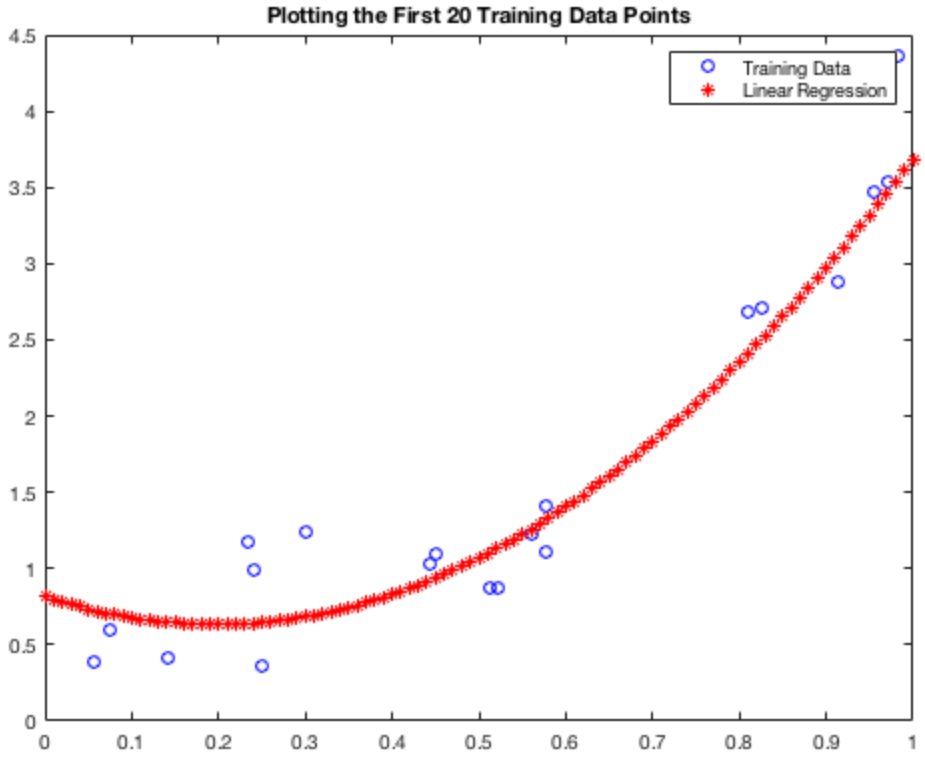
a) Plot the training data

```
plot(Xtr(1:20),Ytr(1:20),'bo');
hold on
title('Plotting the First 20 Training Data Points');
```



b) Create a linear regression learn using the above functions

```
Xtr_2 = [ ones(size(Xtr,1) ,1) , Xtr , Xtr.^2];
learner = linearReg(Xtr_2 ,Ytr); % train a linear regression learner


% plot it on the same plot as the training data
xline = [0:.01:1]';
yline = predict( learner , polyx (xline ,2) );
plot(xline, yline, 'r*');
legend('Training Data','Linear Regression');
```



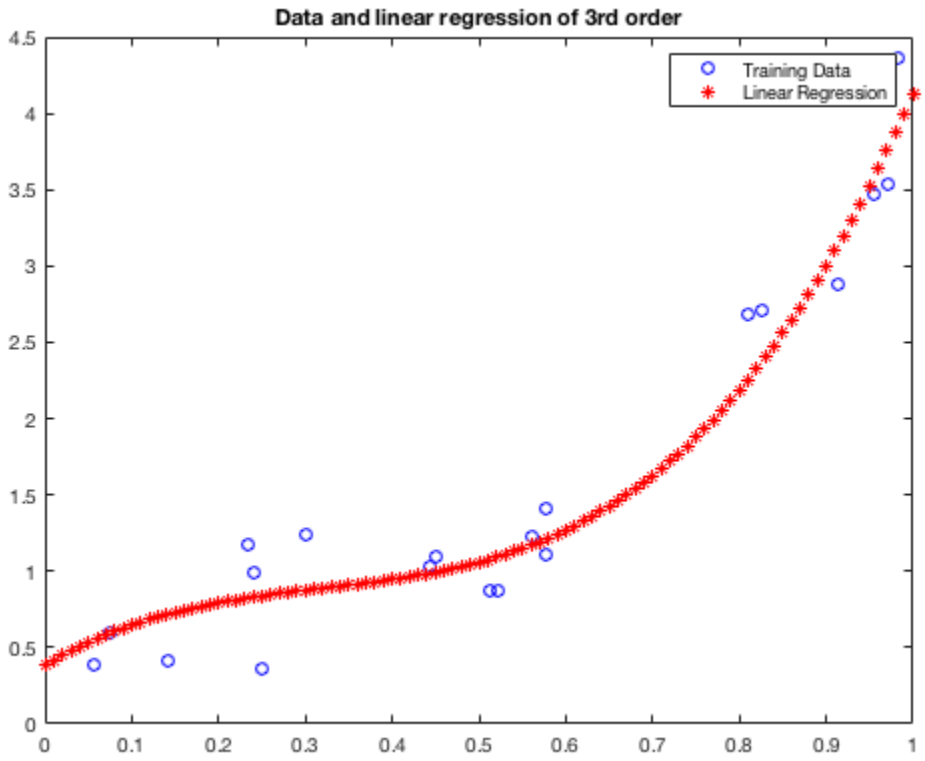
c) Create plots with the data and a higher-order polynomial

3

```
Xtr_3 = [ ones(size(Xtr,1) ,1) , Xtr , Xtr.^2, Xtr.^3];
Xte_3 = [ ones(size(Xte,1) ,1) , Xte , Xte.^2, Xte.^3];

learner = linearReg(Xtr_3 ,Ytr); % train a linear regression learner

yline = predict( learner , polyx (xline ,3) );

% plot it on the same plot as the training data
figure
plot(Xtr(1:20),Ytr(1:20),'bo');
hold on
title('Data and linear regression of 3rd order');
plot(xline, yline, 'r*');
legend('Training Data','Linear Regression');

disp('Training MSE of order 3 regression')
tr_err = mse(learner,Xtr_3,Ytr)
disp('Testing MSE of order 3 regression')
te_err = mse(learner,Xte_3, Yte)
```

```
disp('MAE for order 3 regression')
te_mae = mae(learner,Xte_3, Yte)
```

```
Training MSE of order 3 regression

tr_err =

    0.0828

Testing MSE of order 3 regression

te_err =

    0.0983

MAE for order 3 regression

te_mae =

    0.2777
```

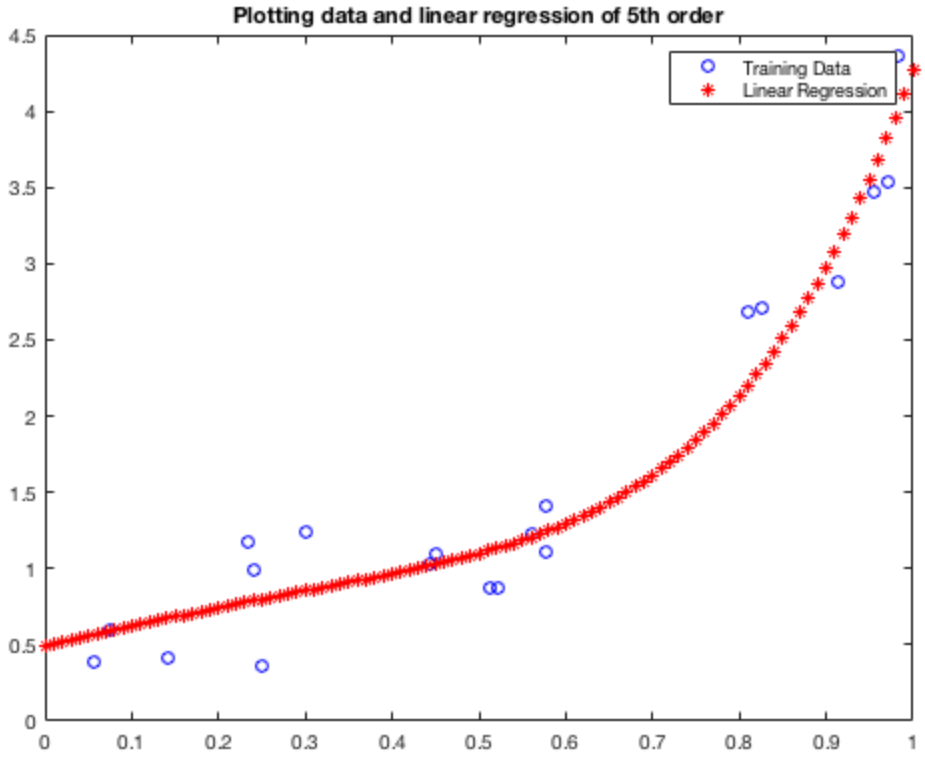


5

```
Xtr_3 = [ ones(size(Xtr,1) ,1) , Xtr , Xtr.^2, Xtr.^3, Xtr.^4,
 Xtr.^5];
```

```
Xte_3 = [ ones(size(Xte,1) ,1) , Xte , Xte.^2, Xte.^3, Xte.^4,
 Xte.^5];

learner = linearReg(Xtr_3 ,Ytr); % train a linear regression learner

yline = predict( learner , polyx (xline ,5) );

% plot it on the same plot as the training data
figure
plot(Xtr(1:20),Ytr(1:20),'bo');
hold on
title('Plotting data and linear regression of 5th order');
plot(xline, yline, 'r*');
legend('Training Data','Linear Regression');

disp('Training MSE of order 5 regression')
tr_err = mse(learner,Xtr_3,Ytr)
disp('Testing MSE of order 5 regression')
te_err = mse(learner,Xte_3, Yte)
disp('MAE for order 5 regression')
te_mae = mae(learner,Xte_3, Yte)
```

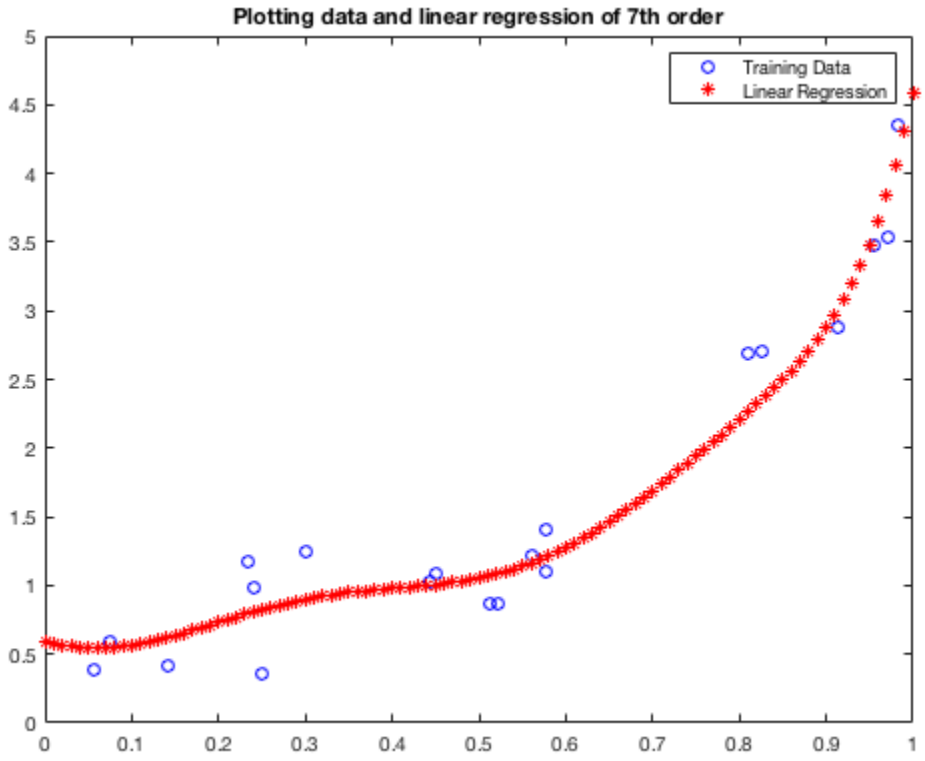
```
Training MSE of order 5 regression

tr_err =

    0.0813

Testing MSE of order 5 regression

te_err =

    0.0959

MAE for order 5 regression

te_mae =

    0.2745
```



7

```
Xtr_3 = [ ones(size(Xtr,1) ,1) , Xtr , Xtr.^2, Xtr.^3, Xtr.^4, Xtr.^5,
 Xtr.^6, Xtr.^7];
Xte_3 = [ ones(size(Xte,1) ,1) , Xte , Xte.^2, Xte.^3, Xte.^4, Xte.^5,
 Xte.^6, Xte.^7];

learner = linearReg(Xtr_3 ,Ytr); % train a linear regression learner

yline = predict( learner , polyx (xline ,7) );

% plot it on the same plot as the training data
figure
plot(Xtr(1:20),Ytr(1:20),'bo');
hold on
title('Plotting data and linear regression of 7th order');
plot(xline, yline, 'r*');
legend('Training Data','Linear Regression');

disp('Training MSE of order 7 regression')
tr_err = mse(learner,Xtr_3,Ytr)
disp('Testing MSE of order 7 regression')
te_err = mse(learner,Xte_3, Yte)
disp('MAE for order 7 regression')
te_mae = mae(learner,Xte_3, Yte)
```

```
Training MSE of order 7 regression

tr_err =

    0.0783

Testing MSE of order 7 regression

te_err =

    0.1094

MAE for order 7 regression

te_mae =

    0.2889
```

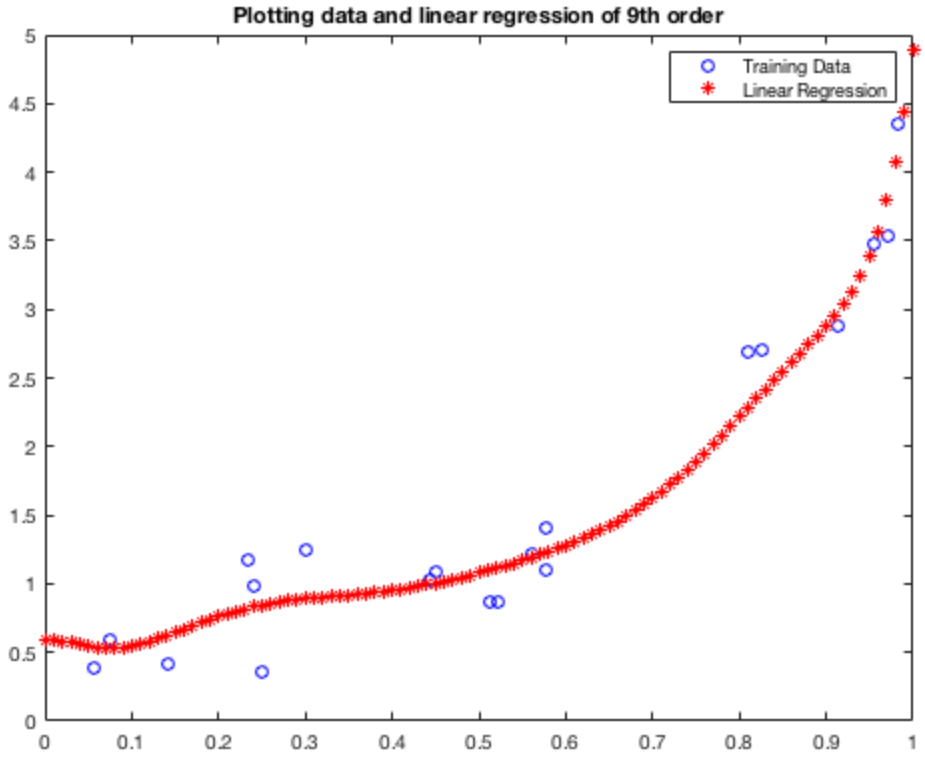


9

```
Xtr_3 = [ ones(size(Xtr,1) ,1) , Xtr , Xtr.^2, Xtr.^3, Xtr.^4, Xtr.^5,
 Xtr.^6, Xtr.^7, Xtr.^8, Xtr.^9];
Xte_3 = [ ones(size(Xte,1) ,1) , Xte , Xte.^2, Xte.^3, Xte.^4, Xte.^5,
 Xte.^6, Xte.^7, Xte.^8, Xte.^9];
```

```
learner = linearReg(Xtr_3 ,Ytr); % train a linear regression learner

yline = predict( learner , polyx (xline ,9) );

% plot it on the same plot as the training data
figure
plot(Xtr(1:20),Ytr(1:20),'bo');
hold on
title('Plotting data and linear regression of 9th order');
plot(xline, yline, 'r*');
legend('Training Data','Linear Regression');

disp('Training MSE of order 9 regression')
tr_err = mse(learner,Xtr_3,Ytr)
disp('Testing MSE of order 9 regression')
te_err = mse(learner,Xte_3, Yte)
disp('MAE for order 9 regression')
te_mae = mae(learner,Xte_3, Yte)
```

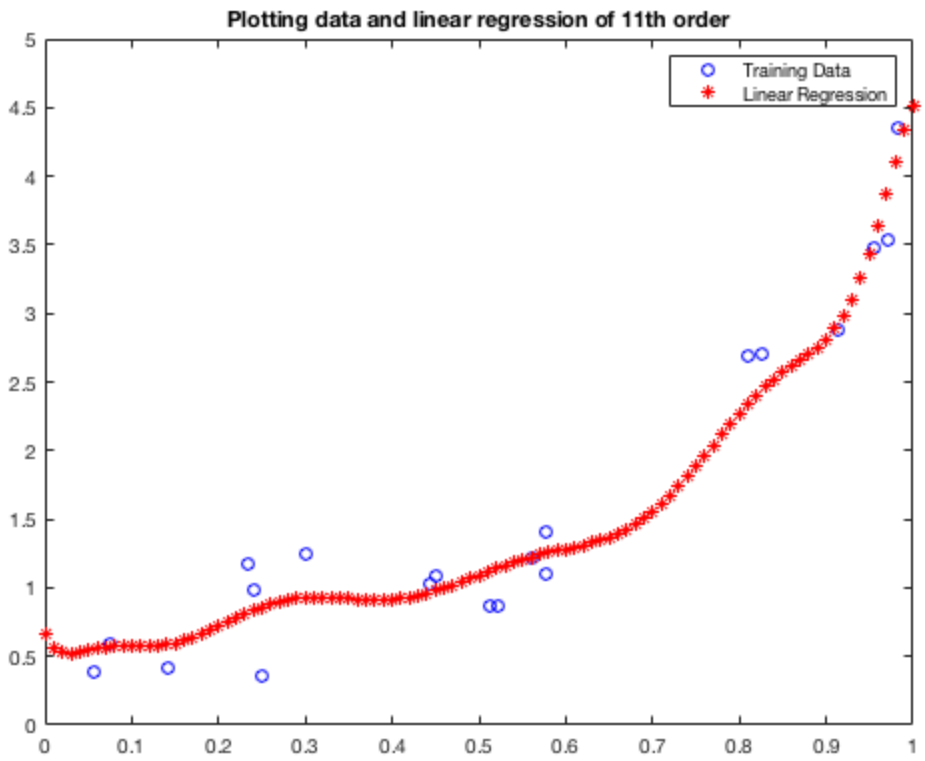
```
Training MSE of order 9 regression

tr_err =

    0.0771

Testing MSE of order 9 regression

te_err =

    0.1135

MAE for order 9 regression

te_mae =

    0.2919
```



11

```
Xtr_3 = [ ones(size(Xtr,1) ,1) , Xtr , Xtr.^2, Xtr.^3, Xtr.^4, Xtr.^5,
 Xtr.^6, Xtr.^7, Xtr.^8, Xtr.^9,  Xtr.^10, Xtr.^11];
Xte_3 = [ ones(size(Xte,1) ,1) , Xte , Xte.^2, Xte.^3, Xte.^4, Xte.^5,
 Xte.^6, Xte.^7, Xte.^8, Xte.^9,  Xte.^10, Xte.^11];

learner = linearReg(Xtr_3 ,Ytr); % train a linear regression learner

yline = predict( learner , polyx (xline ,11) );

% plot it on the same plot as the training data
figure
plot(Xtr(1:20),Ytr(1:20),'bo');
hold on
title('Plotting data and linear regression of 11th order');
plot(xline, yline, 'r*');
legend('Training Data','Linear Regression');

disp('Training MSE of order 11 regression')
tr_err = mse(learner,Xtr_3,Ytr)
disp('Testing MSE of order 11 regression')
te_err = mse(learner,Xte_3, Yte)
disp('MAE for order 11 regression')
te_mae = mae(learner,Xte_3, Yte)
```

```
Training MSE of order 11 regression

tr_err =

    0.0756

Testing MSE of order 11 regression

te_err =

    0.1132

MAE for order 11 regression

te_mae =

    0.2940
```

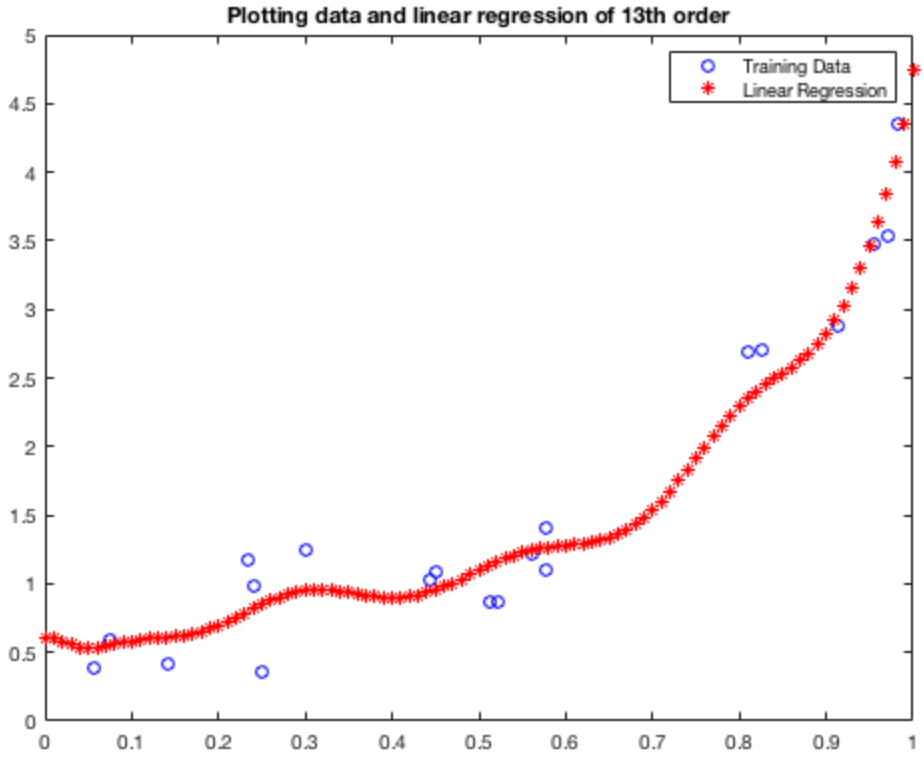


13

```
Xtr_3 = [ ones(size(Xtr,1) ,1) , Xtr , Xtr.^2, Xtr.^3, Xtr.^4,
 Xtr.^5, Xtr.^6, Xtr.^7, Xtr.^8, Xtr.^9,  Xtr.^10, Xtr.^11,  Xtr.^12,
 Xtr.^13];
```

```
Xte_3 = [ ones(size(Xte,1) ,1) , Xte , Xte.^2, Xte.^3, Xte.^4,
 Xte.^5, Xte.^6, Xte.^7, Xte.^8, Xte.^9,  Xte.^10, Xte.^11,  Xte.^12,
 Xte.^13];

learner = linearReg(Xtr_3 ,Ytr); % train a linear regression learner

yline = predict( learner , polyx (xline ,13) );

% plot it on the same plot as the training data
figure
plot(Xtr(1:20),Ytr(1:20),'bo');
hold on
title('Plotting data and linear regression of 13th order');
plot(xline, yline, 'r*');
legend('Training Data','Linear Regression');

disp('Training MSE of order 13 regression')
tr_err = mse(learner,Xtr_3,Ytr)
disp('Testing MSE of order 13 regression')
te_err = mse(learner,Xte_3,Yte)
disp('MAE for order 13 regression')
te_mae = mae(learner,Xte_3, Yte)
```

```
Training MSE of order 13 regression

tr_err =

    0.0750

Testing MSE of order 13 regression

te_err =

    0.1128

MAE for order 13 regression

te_mae =

    0.2925
```



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