

Contents

- Set up Data
- a) Plot the training data
- b) Create a linear regression learn using the above functions
- c) Create plots with the data and a higher-order polynomial
- 3
- 5
- 7
- 9
- 11
- 13

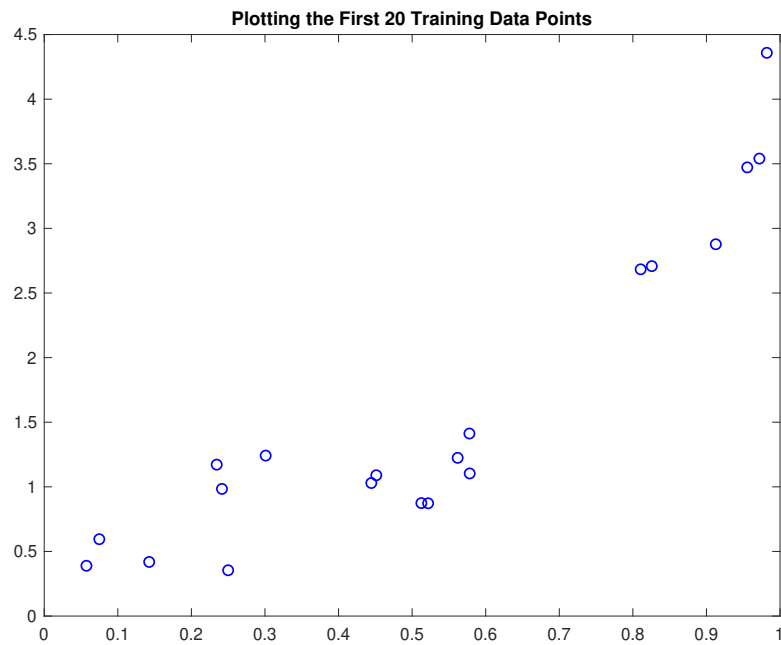
Set up Data

```
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

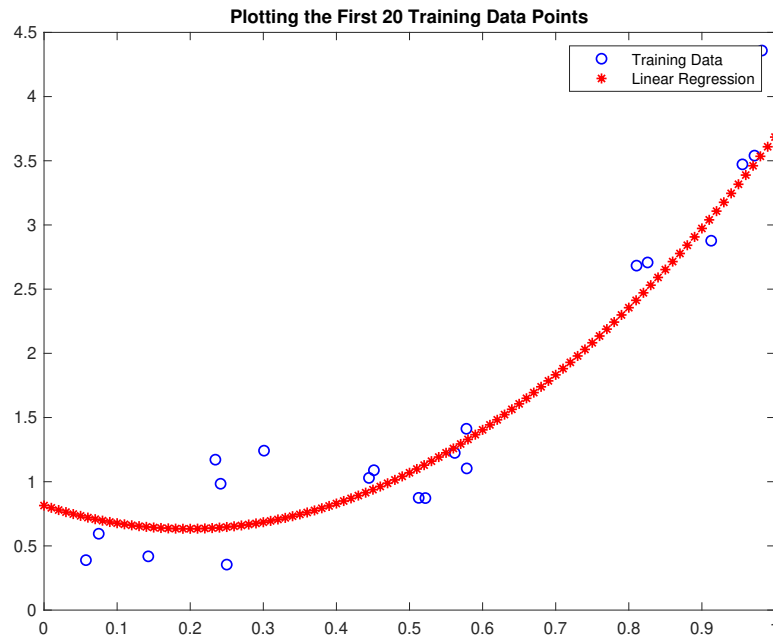
```
plot(Xtr(1:20),Ytr(1:20),'bo');
hold on
title('Plotting the First 20 Training Data Points');
```



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)
```

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)
```

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)
```

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
```

```
ylene = 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)
```

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
```

```
ylene = 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)

```

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 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

```

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

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

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

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

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
```