EECS 738 lab 2 by Zaikun Xu

Part I

experiments

First, fix c = 0.1, p = 2, vary n from 10 to 1000 and calculate the MSE

Second, fix n = 10, p = 2, vary c = 0.01 to 1 and calcualte MSE

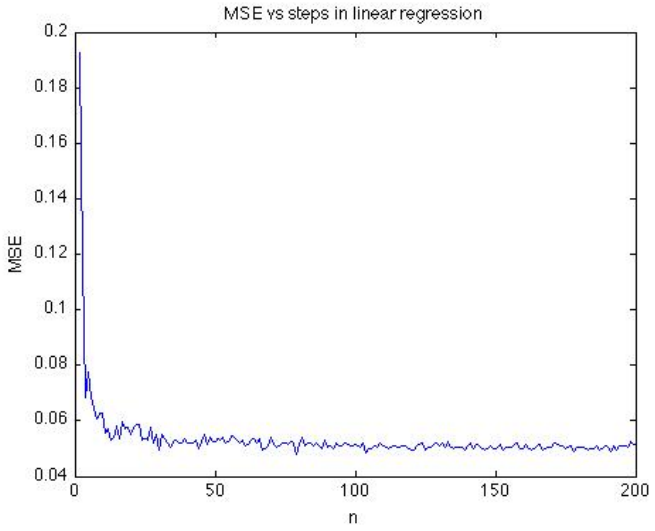
Third, fix n = 1000 > p, c= 0.1, vary p from 2 to 1000, calculate MSE

source code

```
function [m, b] = meanse(n,c, p)
x = 0;
for i= 1:30
x1 = rand(n,p-1)';
x2 = ones(1,n);
X = [x1;x2]' ;
beta = ones(p,1);
elson = rand(n,1);
Y = X * beta + c * elson;
beta_hat = inv(X'*X) * X' * Y ;
x = x + sqrt(sum((beta - beta_hat).^2));
end
m = x/30;
b = beta_hat;
end
```

result analysis

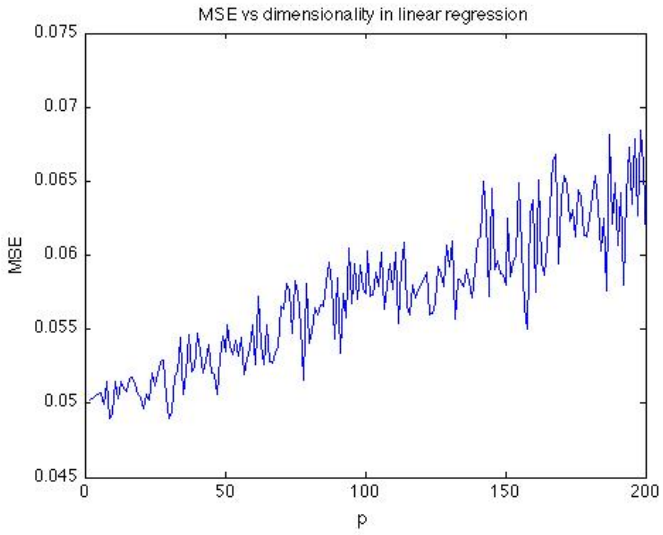
In table1, we can tell that as n increses, the MSE decreases dramatically initially and then after at about n = 20, decreases very slowly. this make sense, because as you have more data, the variance of points will be lower and thus our model can represent the ground truth better.



For table2, as c increases, the MSE increases linearly with c. This also makes sense that c contributes the variance term. as c increses, we have

more noise, then the MSE will increase and should scale linearly with c.

For table3, as P increases, the MSE increases according, in a linear pattern. It also makes sense. As you incerase the dimensonality of data, the effect of curse of dimensionality will be more obvious



Part II (weka)

Introduction

dataset

The dataset is a 1001 by 1559 matrix, where each column is data point and each row is one feature. the data include two classes: advertisement image and non-advertisement image. Features include image url, anchor text, but there are lots of missing values.

model

I choose three models, the Bagging, GaussianProcess and the RBF neural netwrok. The idea of Bagging is to sample your data set multiple times and then use these new dataset to predict. Afterwards, you combine these multiple predictions.

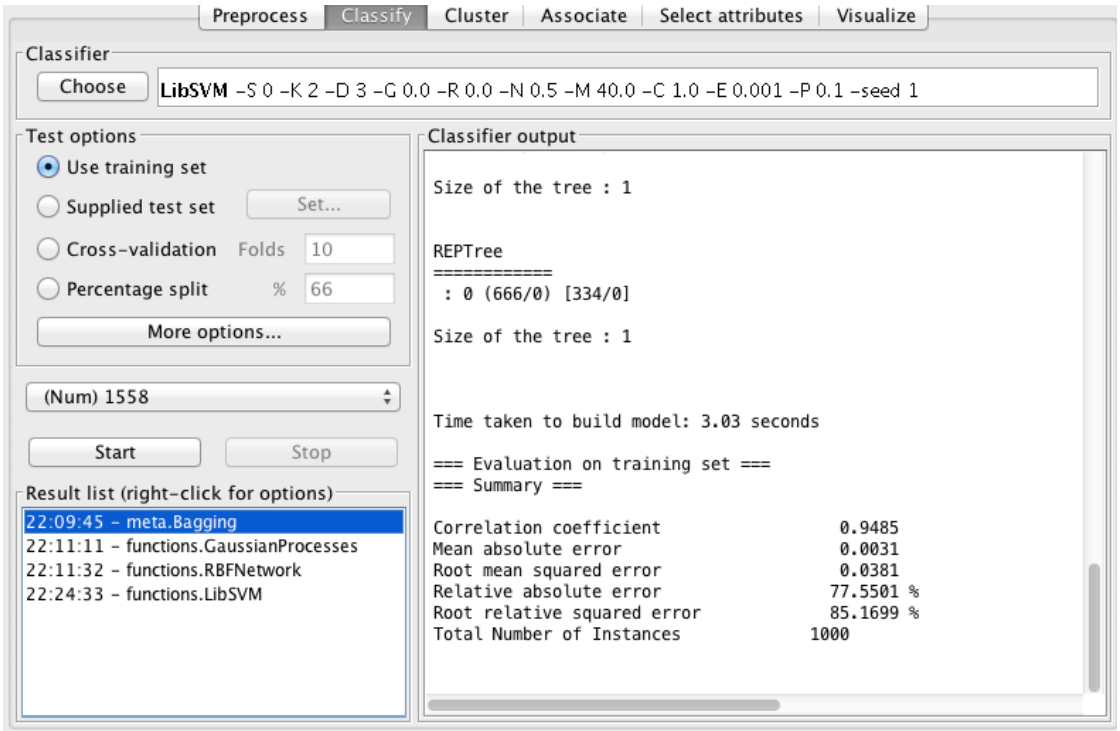
The idea of GaussianProcess is that given N data points, you can use a multivariate Guassian to represent the data and do classification.

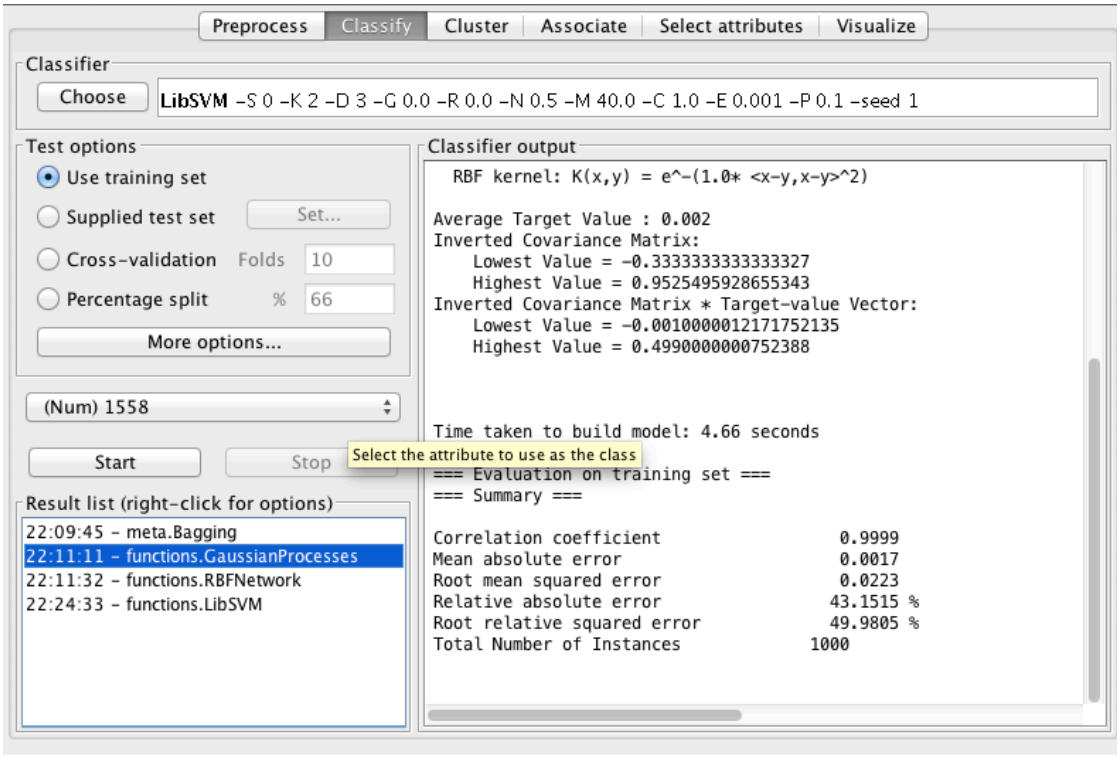
The idea of RBF neural network is as follows: the unknow function f(x) can be approximated by the weighted sum of neurons. From the input layer to the hidden layer, you have a activition funciton , which is a radial basis function. By propagating and udate weights of each neurals, the trained outputs will approximated their real values.

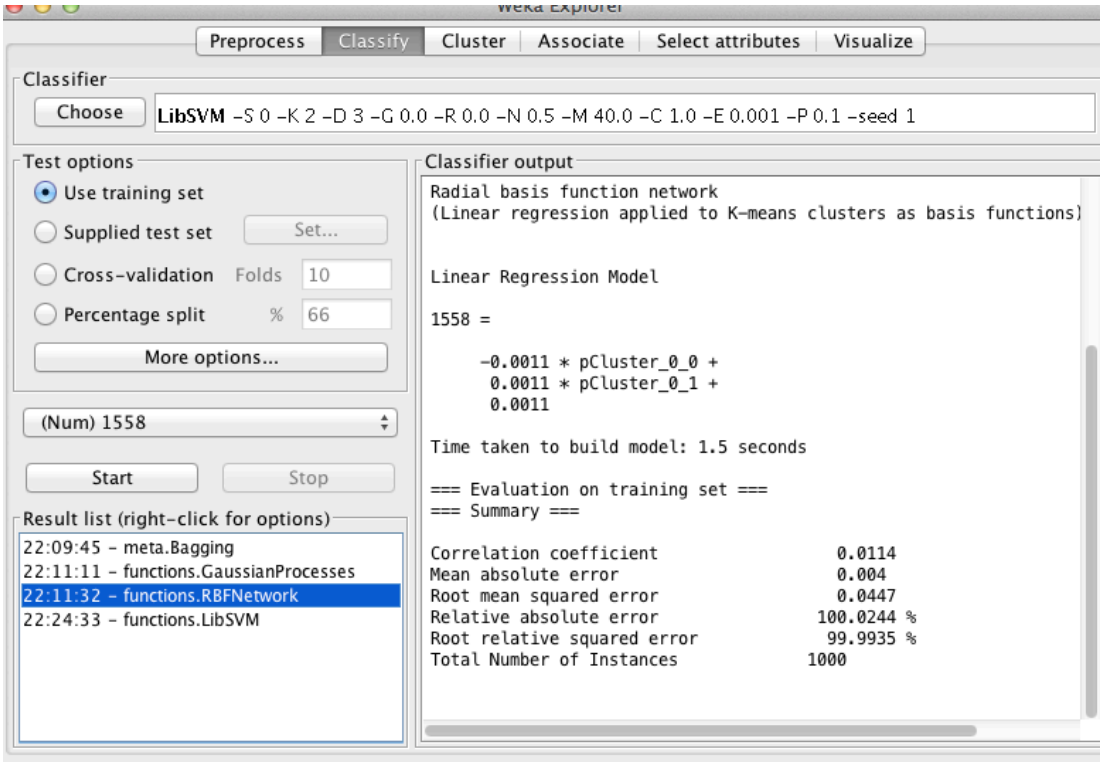
Experiments

For each model, use there different options, namesly, Using training set, cross-validation and percentage split to see how these choices influence the performance of each model.

screen prints for each classifier


Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
LibSVM -S 0 -K 2 -D 3 -G 0.0 -R 0.0 -N 0.5 -M 40.0 -C 1.0 -E 0.001 -P 0.1 -seed 1
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Num) 1558
Start
Stop
Result list (right-click for options)
22:09:45 - meta.Bagging
22:11:11 - functions.GaussianProcesses
22:11:32 - functions.RBFNetwork
22:24:33 - functions.LibSVM
Classifier output
Size of the tree : 1
REPTree
============
: 0 (666/0) [334/0]
Size of the tree : 1
Time taken to build model: 3.03 seconds
=== Evaluation on training set ===
=== Summary ===
Correlation coefficient 0.9485
Mean absolute error 0.0031
Root mean squared error 0.0381
Relative absolute error 77.5501 %
Root relative squared error 85.1699 %
Total Number of Instances 1000


Preprocess
Classify
Cluster
Associate
Select attributes
Visualize
Classifier
Choose
LibSVM -S 0 -K 2 -D 3 -G 0.0 -R 0.0 -N 0.5 -M 40.0 -C 1.0 -E 0.001 -P 0.1 -seed 1
Test options
Use training set
Supplied test set
Set...
Cross-validation
Folds
10
Percentage split
%
66
More options...
(Num) 1558
Start
Stop
Select the attribute to use as the class
Result list (right-click for options)
22:09:45 - meta.Bagging
22:11:11 - functions.GaussianProcesses
22:11:32 - functions.RBFNetwork
22:24:33 - functions.LibSVM
Classifier output
RBF kernel: K(x,y) = e^-(1.0* <x-y,x-y>^2)
Average Target Value : 0.002
Inverted Covariance Matrix:
Lowest Value = -0.3333333333333327
Highest Value = 0.9525495928655343
Inverted Covariance Matrix * Target-value Vector:
Lowest Value = -0.0010000012171752135
Highest Value = 0.4990000000752388
Time taken to build model: 4.66 seconds
=== Evaluation on training set ===
=== Summary ===
Correlation coefficient 0.9999
Mean absolute error 0.0017
Root mean squared error 0.0223
Relative absolute error 43.1515 %
Root relative squared error 49.9805 %
Total Number of Instances 1000



results and analysis

	Bagging			Gaussian Process			RBF neural network		
	Training set	Cross-validation	80% to 20 % split	Training set	Cross-validation	80% to 20 % split	Training set	Cross-validation	80% to 20 % split
Training error	0.0031	0.0036	0.006	0.0017	0.0034	0.0058	0.004	0.0039	0.0063
SD	0.0381	0.0457	0.0706	0.0223	0.0447	0.0706	0.0447	0.0449	0.0707

Compare between models

Gussian Process works slightly better than the other two models for both training error and standard derivation.

Compare between training choices

If choose traing set , the overall training error is the lowest. 80% split makes the training error worse. Cross-validation is in the middle.