T-61.6040 Assignment-06/2011

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AIM

Implemention of bayesian kernel methods for regression algorithm discussed in the lecture using gaussian for a motorcycle dataset.

$$k_{GAU} = (x_i, x_j) = exp(-\|x_i x_j\|_2^2/s^2),\ and\ s = \{0.4, 0.8, 1.6\},\ and\ A = \{1, 2, 4\}. \quad (1)$$

Datasets

Motorcycle dataset for regression analysis.

Implementation

Load and zscore normalize the X and sort X and Y values. Zscore normalization can also be done using the method described in the lecture.

```
X1 = zscore(dlmread('motorcycle_X.txt'));
Y = dlmread('motorcycle_y.txt');
[X idx] = sort(X1);Y = Y(idx);
```

Calculate Gaussian kernel function.

```
K = exp(-pdist2(X,X).^2/S(i).^2);
```

Find the inverse and calculate the alpha values

```
[M ,N] = size(K);
KC = (K + a(j)^2 .* eye(N, N)) \ eye(N, N);
alpha = KC*Y;
```

Generate uniform distribution of values and calculate the variance

```
X_s = linspace(-2, 2.5, 200)';
K_s = exp(-pdist2(X,X_s).^2/S(k).^2);
for iter = 1:200
temp1(iter) = a(j).^2-(K_s(:,iter)'*KC*K_s(:,iter));
end
variance = temp1' + diag((exp(-pdist2(X_s,X_s).^2/S(k).^2)));
```

Calculate the mean

```
meen = K_s'*alpha;
```

Plot the mean and standard deviations on the data

```
fh(Count) = scatter(X,Y);
hold on
plot(X_s,meen,'k--')
hold on
plot(X_s,meen+3*sqrt(variance),'r--');
hold on
plot(X_s,meen-3*sqrt(variance),'r--');
```

save the plots

```
title(['A =',num2str(a(j)) ,' S = ',num2str(S(k))]);
  %---print figure---
   fnout = ['Count=', num2str(Count,'%.2d'), '.jpg'];
   print('-djpeg','-r150',fnout);
   clf;
```

The Gaussian kernel implementation is carried out for all the values of $s = \{0.4, 0.8, 1.6\}$, *and* $A = \{1, 2, 4\}$. for dataset and these plots are shown in figure 1, 2 and 3 respectively.

Running of code for Gaussian kernel in matlab are 'guass'.

Results

Figure 3 showing the Gaussian process algorithm on motorcycle data tending towards a linear fit.

References

[1] Lecture slides and course book.

Attachments

Matlab code guass.m and datasets have been archived along with this report.

Figure 1: Gaussian process algorithm on motorcycle data.

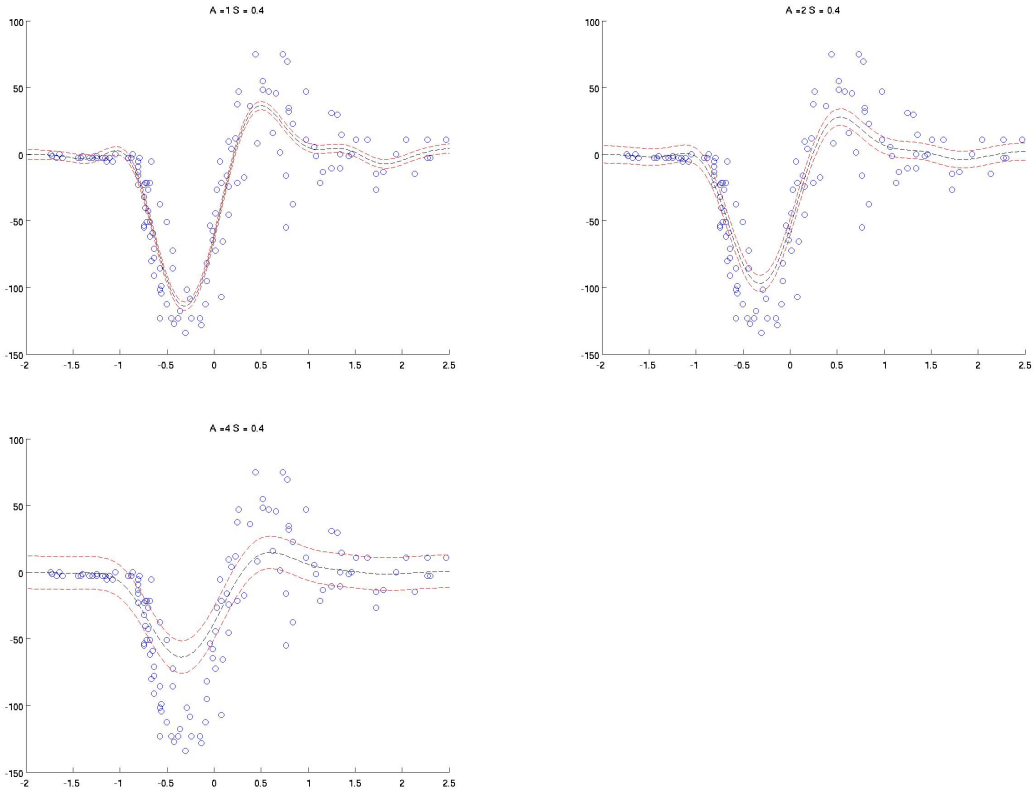

Figure 2: Gaussian process algorithm on motorcycle data.

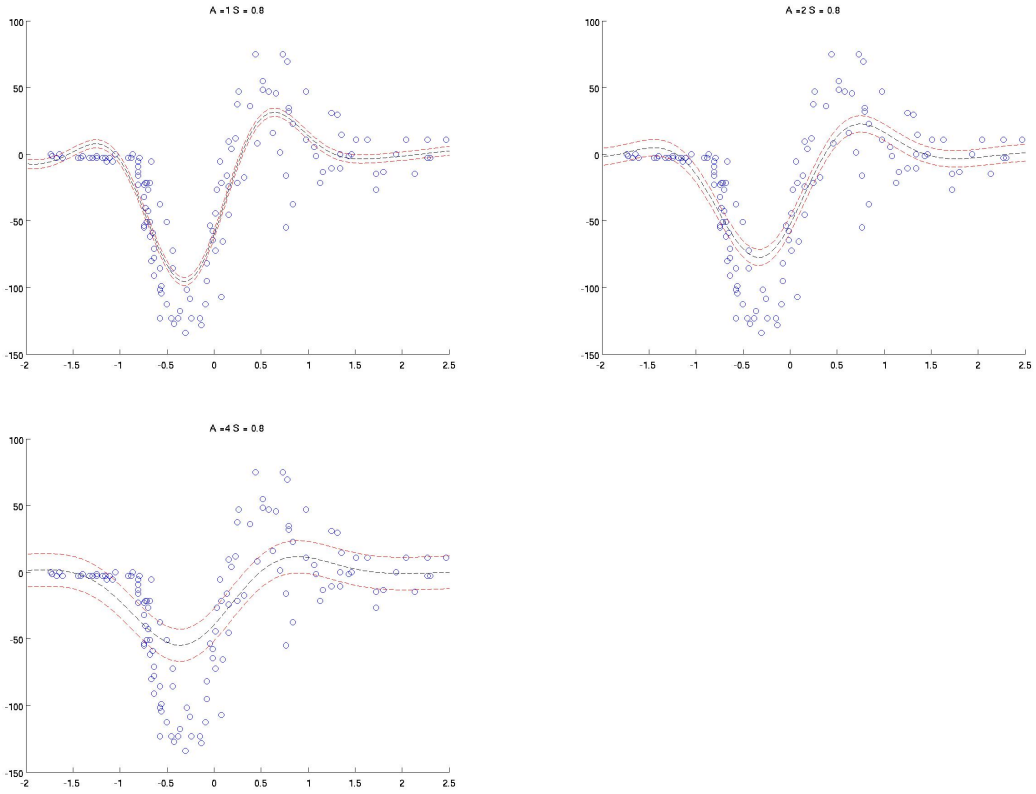

Figure 3: Gaussian process algorithm on motorcycle data.