ECS797 Machine Learning for Visual Data Analysis

Lab 3: Age Estimation by Regression

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3. Complete the lab3.m file

4. Compute the MAE and CS value (with a cumulative error level of 5) by comparing the estimated ages with the ground truth ages. You need to write your own code here.

```
%% Compute the MAE and CS value (with cumulative error level of 5) for linear regression

MAE = sum(abs(yhat_test - ytest))/(size(ytest,1))

a = abs(yhat_test - ytest);
CS = size(find(a<= err_level))/size(a) * 100
```

The above code computes MAE and CS values by comparing the estimated ages with the ground truth ages.

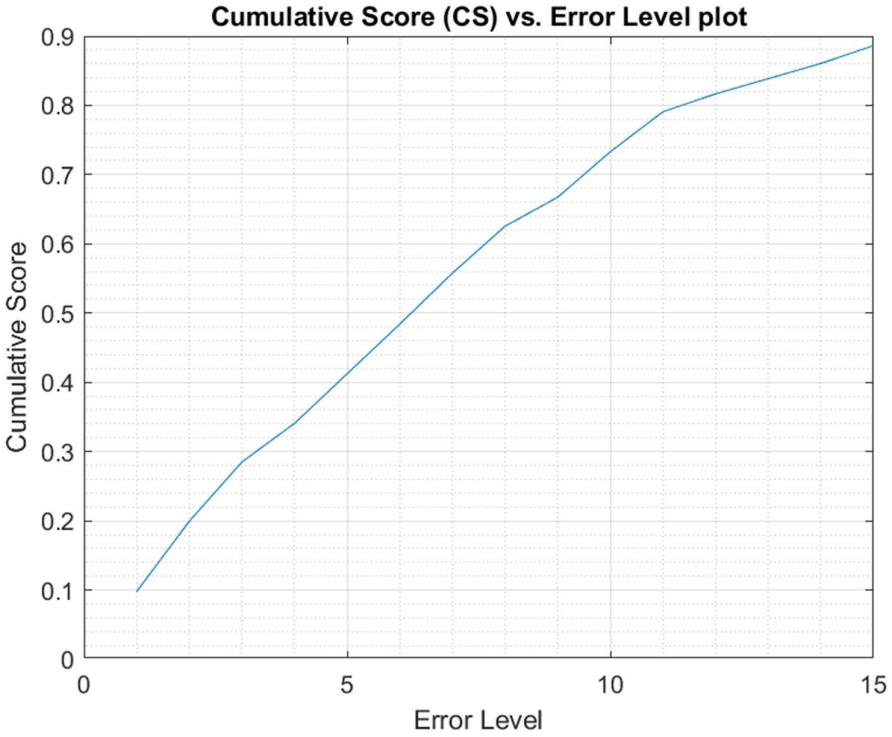
MAE and CS results:

```
MAE =

    7.7044


CS =

   41.2353
```

5. Vary the cumulative error level from 1 to 15 and generate a plot of the CS value against the cumulative error level. You need to write your own code here. See the lecture slides for week 6 for an example of the plot.

```
%% generate a cumulative score (CS) vs. error level plot by varying the error level from 1 to 15. The plot
values = [];
err_lvl = [];
for i = 1:15
    cum_score = size(find(a<= i))/size(a);
    values = [values, cum_score];
    err_lvl = [err_lvl, i];
end

% plot CS vs Error Level
figure(1)
plot(err_lvl, values)
xlabel('Error Level')
ylabel('Cumulative Score')
title('Cumulative Score (CS) vs. Error Level plot')
grid on
grid minor
```

The code vary the cumulative error level from 1 to 15. Where it computes and generate a plot of CS values against the error level(plot shown below).



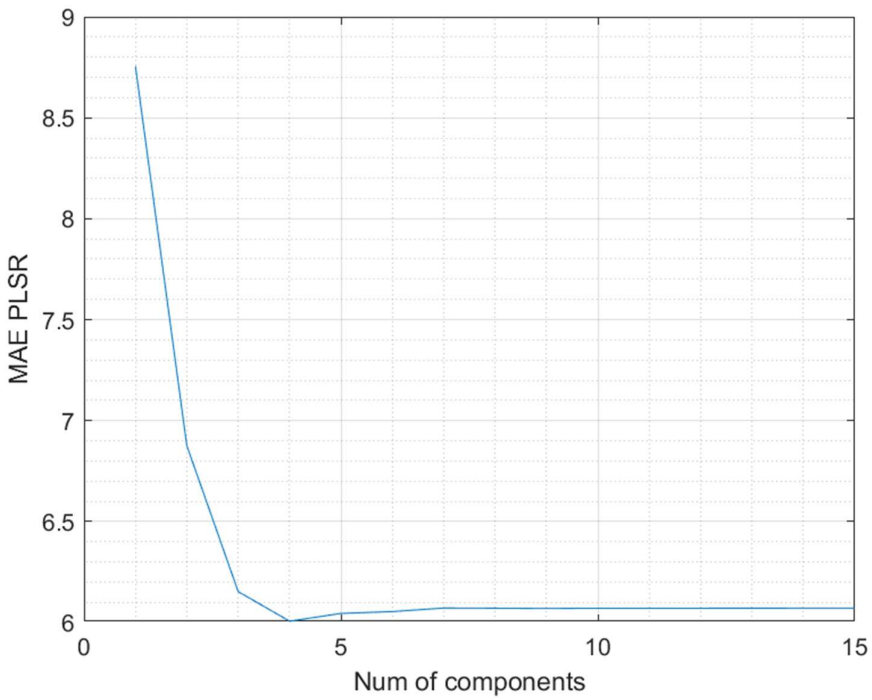
6. Compute the MAE and CS values (with cumulative error level of 5) for both partial least square regression model and the regression tree model by using the MATLAB built-in functions. You need to write your own code here.

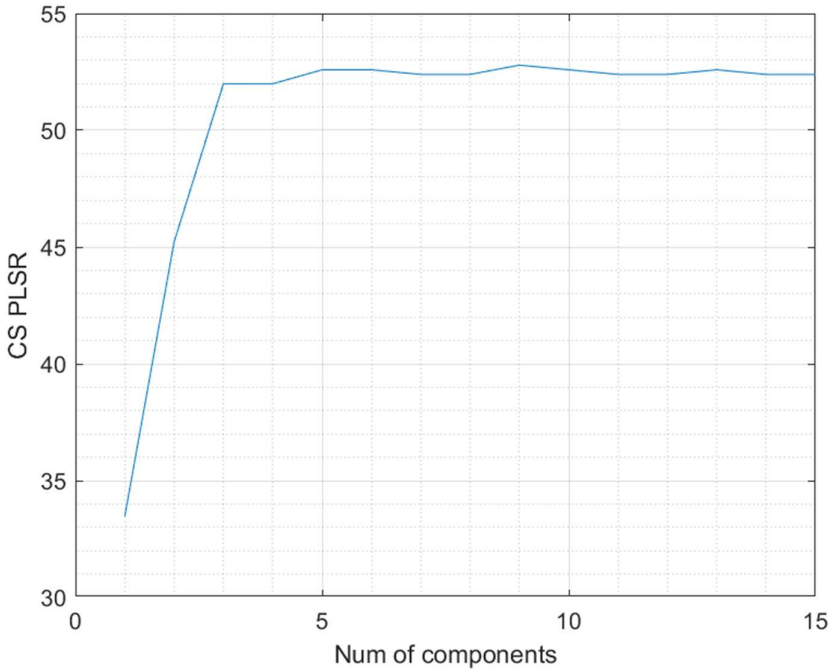
```
%% Compute the MAE and CS value (with cumulative error level of 5) for both partial least square regression

%partial least square regression
mae_plsr = [];
cs_plsr = [];

components = [];
for i = 1:15
    [XL,YL,XS,YS,BETA] = plsregress(xtrain, ytrain, i);
    yhat_test_plsr = [ones(size(xtest,1),1),xtest]*BETA;
    mae_plsr = [mae_plsr, sum(abs(yhat_test_plsr - ytest))/(size(ytest,1))];

    b = abs(yhat_test_plsr - ytest);
    cs = size(find(b<= err_level))/size(b) * 100;
    cs_plsr = [cs_plsr, cs];

    components = [components, i];
end
```

The above code computes MAE and CS values with cumulative error level 5 for partial least square regression model using MATLAB built in function 'plsregress'. Where its calculated with different number of components ranging from 1 to 15(as shown above) and the best MAE is selected (shown below).

```
%PLOT MAE plsr
figure(2)
plot(components, mae_plsr)
xlabel('Num of components')
ylabel('MAE PLSR')
grid on
grid minor

%PLOT CS plsr
figure(3)
plot(components, cs_plsr)
xlabel('Num of components')
ylabel('CS PLSR')
grid on
grid minor
```

The above code plots the MAE and CS graph with different number of components. Plots shown below.






```
% best MAE from ncomps
mae_lsr = min(mae_plsr)
% corresponding CS
cs_lsr = cs_plsr(find(mae_plsr == mae_lsr))
```

Then the best MAE and corresponding CS is selected and the results are recorded as shown below.

Partial Least Square regression MAE and CS results:

```
mae_lsr =

    6.0062


cs_lsr =

   51.9922
```

```
% Regression tree model

mae_rt = [];
cs_rt = [];

reg_tree = fitrtree(xtrain, ytrain);
yhat_test_reg = predict(reg_tree, xtest);
mae_rt = [sum(abs(yhat_test_reg - ytest))/(size(ytest,1))]

c = abs(yhat_test_reg - ytest);
cs_rt = size(find(c<= err_level))/size(c) * 100
```

The above code computes MAE and CS values with cumulative error level 5 for regression tree model using MATLAB built in function 'fitrtree'.

Regression Tree MAE and CS results:

```
mae_rt =

    8.2350


cs_rt =

   50.3986
```

7. Compute the MAE and CS values (with cumulative error level of 5) for Support Vector Regression by using the LIBSVM toolbox (http://www.csie.ntu.edu.tw/~cjlin/libsvm/). This step is worth 15% of the total mark for this lab.

```
%% Compute the MAE and CS value (with cumulative error level of 5) for Support Vector Regression by using LIBSVM toolbox

mae_svm = [];
cs_svm = [];

svm = fitrsvm(xtrain, ytrain);
yhat_test_svm = predict(svm, xtest);
mae_svm = [sum(abs(yhat_test_svm - ytest))/(size(ytest,1))]

d = abs(yhat_test_svm - ytest);
cs_svm = size(find(d<= err_level))/size(d) * 100
```

The above code computes MAE and CS values for support Vector Regression. Fitrsvm and predict is used to compute the MAE and CS.

Support Vector Regression MAE and CS results:

```
mae_svm =

    5.7314


cs_svm =

   53.7850
```

A table to compare the four different regression models using both MAE and CS with an error level of 5.

```
% table displaying MAE and CS values and Algorithms

values = {'Linear Regression' MAE CS; 'PLS Regression' mae_lsr cs_lsr; 'Regression Tree' mae_rt cs_rt; 'Support Vector Regression' mae_svm cs_svm};
T = cell2table(values, 'VariableNames',{'Algorithm' 'MAE' 'CS'})
```

The above code make and table T and assign values to the table, to compare four different regression models using both MAE and CS with an error level of 5.

Algorithm	MAE	CS
{'Linear Regression' }	7.7044	41.235
{'PLS Regression' }	6.0062	51.992
{'Regression Tree' }	8.235	50.399
{'Support Vector Regression'}	5.7314	53.785

All the experiments results are displayed above in the table, SVM seem to perform better in facial age estimation.