SVM vs. Bayes Classifier

CS 479 Assignment 4

Ethan Brown, Ethan Park

Date Due: May 5, 2020

Date Handed In: May 5, 2020

Division of Work:

Ethan Brown and Ethan Park worked together on the programming side of the assignment, but Ethan Brown focused more on experiment 2 and Ethan Park focused more on experiment 1. For the report, Ethan Park worked on the Theory, Implementation, and Source Code, and Ethan Brown worked on the Results and Discussion.

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**Theory**

The first experiment involves using Support Vector Machines (SVMs) for gender classification. SVMs use structural risk minimization to get good generalization performance. The dataset for this experiment contains 400 (either 16x20 or 48x60) distinct images of individuals separated into three folds with pre-computed eigen-face representations and classification labels.

The advantage of structural risk minimization over empirical risk minimization is that the complexity (or capacity) of learnt functions are controlled which ensures good generalization performance. To get an optimal hyperplane (decision boundary), such a hyperplane would have to give the largest margin of separation between classes. One can find the largest margin of separation by minimizing the Vapnik-Chervonenkis (VC) dimension which is a common way to measure the capacity of a classifier. It measures capacity by predicting a probabilistic upper bound on the generalization error of the classifier. Vapnik was able to prove that a classifier generalizes well, regardless of the dimensionality of the input space, if it minimizes empirical risk and has a low VC dimension.

Typically, SVMs are two-class classifiers that can be extended to support multi-class classification. Data can be transformed to a higher dimension using kernel functions which can help SVMs find optimal discriminants. The goal of transforming data to a higher dimension is that it may allow the data to become linearly separable. In the case of this experiment, polynomial and radial basis function (RBF) kernels are used.

The polynomial kernel is given by

and the RBF kernel is given by

with , , and as kernel parameters. The first experiment will involve adjusting various parameters and observing the changes of accuracy for the SVM on the three folds.

The second experiment involves applying a Basyesian classifier for the same problem (for comparison purposes) using a Gaussian distribution and Maximum Likelihood (ML) estimation to estimate the parameters for each class. For a more indepth look at Bayes classifier using Gaussian distribution and ML estimation, refer to the second project assignment report.

**Implementation**

For the first experiment, LibSVM was used to implement the SVMs needed for the experiment. To use LibSVM, the data first had to be formatted properly such that it could be processed by LibSVM. Proper formatting was achieved by first manually changing the data for the pre-computed eigen-face representations such that it was row-based rather than column-based. This change was made such that the data could be more easily reformatted using a c++ code. The specific code created for this purpose was the function, generate\_data, which takes in the name of the file containing data, the type of data (training, testing, or validation), and the image type (16x20 or 48x60) and formats the data in a way that LibSVM can be used. It does this by pairing up the label and the corresponding eigen-face representation (in this order explicitly) on each line of the file. Afterwards the reformatted validation data is added to the test data as validation data is considered test data for this experiment. To run LibSVM bash files, PA4-svm-train.sh and PA4-svm-test.sh, containing the commands for training and testing respectively were created. Once ran the command, head -1 \*.output > svm\_results.txt, was used to create a text file of the results.

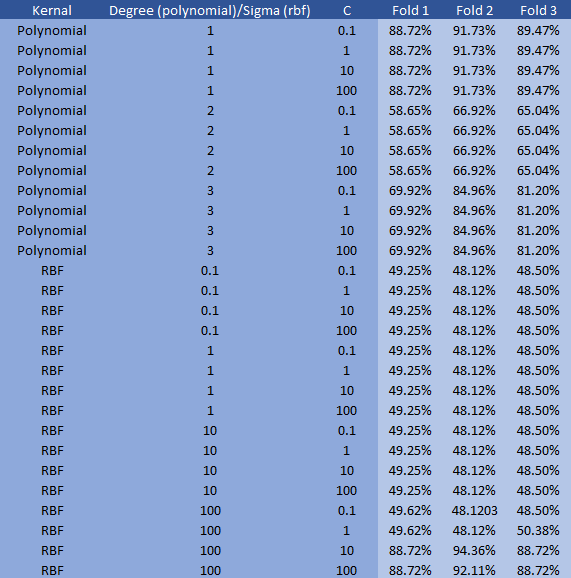
For the second experiment, many of the same functions from previous project assignments were used. For brevity, these functions will only be described briefly. Ml\_mean and ml\_covariance

Find the ML mean and covariance respectively, discriminant\_case\_3 finds the third discriminant case of the Bayesian classifier, and classify\_case\_3 makes a classification decision based on the third discriminant case. The only new function created was readFaces which which takes in the files for the pre-computed eigen-face representations and labels and stores this information into the the vector maleFaces if the data is for a male and femaleFaces if the data is for a female. As with previous project assignments, vectors (VectorXf) were used to hold the data and means while matrices (MatrixXf) were used to hold the covariances.

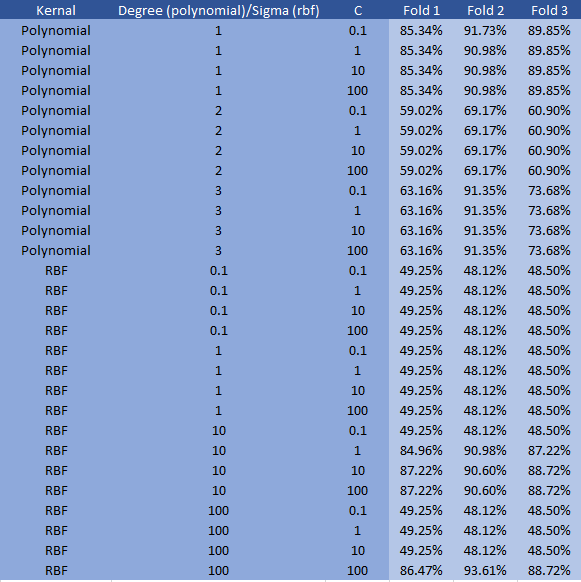
**Results and Discussion**

Experiment 1

For this experiment, we used the LibSVM library to first train and then test the classifier with varying parameters including kernel, polynomial, rbf, and C. We also repeated the experiment using the high resolution images (48x60) and low resolution images (16x20). The results for the high resolution images can be seen in Figure 1, and the results for the low resolution images can be seen in Figure 2. The results from the high resolution images are very similar to the results from the low resolution test which suggests that resolution does not have a significant impact on classification performance.



**Figure 1** shows the results from experiment 1 using the high resolution images. When using a polynomial kernel, the classifier performs best when the degree is small, and it does not vary as C changes. When using an RBF kernel, the classifier performs best when sigma is larger, and once again the value of C does not make much of a difference with classification performance except when sigma is 100.



**Figure 2** shows the results from experiment 1 using the low resolution images. Similar to the high resolution images, the polynomial kernel performs best when the degree is small, and once again, changing the value of C has a very minimal effect on classification. Also similar to the high resolution images, the RBF kernel performs best when sigma is larger, and varying C has a minimal effect on classification performance. The results of the low resolution images are very similar to the results from the high resolution images which suggests that resolution does not have a significant impact on classification performance.

Experiment 2

For this experiment, we used the maximum likelihood technique to generate the sample mean and covariance to use with a Bayes classifier. We used the same images and folds from experiment 1, the only difference is the type of classifier we used. The results can be seen in Figure 3. The different classification accuracies for the various folds and resolutions are all right around 50% which is significantly worse than using an SVM with optimal parameters. Additional information about each fold can be seen in Figures 4-9.

| Resolution | Fold 1 | Fold 2 | Fold 3 | Average |
| --- | --- | --- | --- | --- |
| 16x20 | 53.01% | 49.25% | 51.13% | 51.13% |
| 48x60 | 49.25% | 49.25% | 52.26% | 50.25% |

**Figure 3** shows the results from experiment 2. For each fold, the classification accuracy is nearly 50% which makes it about the same as randomly guessing male or female for each sample. Like experiment 1, the different resolution did not have a significant impact on classification performance.

| Number of Faces Tested | 266 |
| --- | --- |
| Male Correct | 45 |
| Female Correct | 96 |
| Total Correct | 141 |
| Percentage | 53.0075% |

**Figure 4** shows the details for fold 1 in experiment 2 using low resolution images.

| Number of Faces Tested | 266 |
| --- | --- |
| Male Correct | 76 |
| Female Correct | 55 |
| Total Correct | 131 |
| Percentage | 49.2481% |

**Figure 5** shows the details for fold 2 in experiment 2 using low resolution images.

| Number of Faces Tested | 266 |
| --- | --- |
| Male Correct | 66 |
| Female Correct | 70 |
| Total Correct | 136 |
| Percentage | 51.1278% |

**Figure 6** shows the details for fold 3 in experiment 2 using low resolution images.

| Number of Faces Tested | 266 |
| --- | --- |
| Male Correct | 46 |
| Female Correct | 85 |
| Total Correct | 131 |
| Percentage | 49.2481% |

**Figure 7** shows the details for fold 1 in experiment 2 using high resolution images.

| Number of Faces Tested | 266 |
| --- | --- |
| Male Correct | 70 |
| Female Correct | 61 |
| Total Correct | 131 |
| Percentage | 49.2481% |

**Figure 8** shows the details for fold 2 in experiment 2 using high resolution images.

| Number of Faces Tested | 266 |
| --- | --- |
| Male Correct | 78 |
| Female Correct | 61 |
| Total Correct | 139 |
| Percentage | 52.2556% |

**Figure 9** shows the details for fold 3 in experiment 2 using high resolution images.

**Source Code**

Generate\_SVM\_Data.cpp

#include <iostream>

#include <vector>

#include <Eigen/Dense>

#include <cstdlib>

#include <fstream>

#include <sstream>

using namespace Eigen;

using namespace std;

int TRAINING = 1;

int TESTING = 2;

void generate\_data(char\* filename, int datatype, string imagetype);

int main()

{

char filename[256];

// reformat data for all training, test, and validation files

for(int i=1;i<=3;i++)

{

sprintf(filename, "trPCA\_0%i", i);

generate\_data(filename, TRAINING, "16\_20");

sprintf(filename, "tsPCA\_0%i", i);

generate\_data(filename, TESTING, "16\_20");

sprintf(filename, "valPCA\_0%i", i);

generate\_data(filename, TESTING, "16\_20");

sprintf(filename, "trPCA\_0%i", i);

generate\_data(filename, TRAINING, "48\_60");

sprintf(filename, "tsPCA\_0%i", i);

generate\_data(filename, TESTING, "48\_60");

sprintf(filename, "valPCA\_0%i", i);

generate\_data(filename, TESTING, "48\_60");

}

}

void generate\_data(char\* filename, int datatype, string imagetype)

{

// get input and output file streams

string inFile = "./genderdata/";

inFile += imagetype;

inFile += "/";

inFile += imagetype;

inFile += "\_reformatted\_data/";

string curData = "";

char curLabel;

ifstream finData;

ifstream finLabel;

istringstream iss;

string output\_name = "./New\_SVM\_Data/";

output\_name += imagetype;

output\_name += "-";

output\_name += filename;

output\_name += "-new.txt";

ofstream file\_output(output\_name);

float curFloat = 0.0;

int counter = 1;

inFile += filename;

inFile += "-new.txt";

finData.open(inFile);

inFile = "./genderdata/";

inFile += imagetype;

inFile += "/T";

inFile += filename;

inFile += ".txt";

finLabel.open(inFile);

char temp;

// combine the labels and eigen face representations

// for each line:

// <label> <eigen face representation>

// first 30 for training

if(datatype == TRAINING)

{

int eigen\_index = 0;

while(eigen\_index < 30 && getline(finData, curData) && finLabel.get(curLabel))

{

while(curLabel == ' ')

{

finLabel.get(curLabel);

}

file\_output << curLabel;

iss.clear();

iss.str(curData);

counter = 1;

while(iss >> curFloat)

{

file\_output << " " << counter << ":" << curFloat;

counter++;

}

file\_output << endl;

eigen\_index++;

}

}

// all for test and validation

else if(datatype == TESTING)

{

while(getline(finData, curData) && finLabel.get(curLabel))

{

while(curLabel == ' ')

{

finLabel.get(curLabel);

}

if(curLabel != '1' && curLabel != '2')

{

break;

}

/\*

if(curLabel == '\0')

{

break;

}\*/

file\_output << curLabel;

iss.clear();

iss.str(curData);

counter = 1;

while(iss >> curFloat)

{

file\_output << " " << counter << ":" << curFloat;

counter++;

}

file\_output << endl;

}

}

// close stream

finData.close();

finLabel.close();

file\_output.close();

}

PA4-svm-train.sh

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 1 -c 0.1 New\_SVM\_Data/16\_20-trPCA\_01-new.txt 16\_20-poly01-D1C0\_1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 2 -c 0.1 New\_SVM\_Data/16\_20-trPCA\_01-new.txt 16\_20-poly01-D2C0\_1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 3 -c 0.1 New\_SVM\_Data/16\_20-trPCA\_01-new.txt 16\_20-poly01-D3C0\_1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 1 -c 1 New\_SVM\_Data/16\_20-trPCA\_01-new.txt 16\_20-poly01-D1C1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 2 -c 1 New\_SVM\_Data/16\_20-trPCA\_01-new.txt 16\_20-poly01-D2C1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 3 -c 1 New\_SVM\_Data/16\_20-trPCA\_01-new.txt 16\_20-poly01-D3C1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 1 -c 10 New\_SVM\_Data/16\_20-trPCA\_01-new.txt 16\_20-poly01-D1C10.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 2 -c 10 New\_SVM\_Data/16\_20-trPCA\_01-new.txt 16\_20-poly01-D2C10.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 3 -c 10 New\_SVM\_Data/16\_20-trPCA\_01-new.txt 16\_20-poly01-D3C10.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 1 -c 100 New\_SVM\_Data/16\_20-trPCA\_01-new.txt 16\_20-poly01-D1C100.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 2 -c 100 New\_SVM\_Data/16\_20-trPCA\_01-new.txt 16\_20-poly01-D2C100.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 3 -c 100 New\_SVM\_Data/16\_20-trPCA\_01-new.txt 16\_20-poly01-D3C100.model

./libsvm-3.24/svm-train -t 2 -g 50 -r 0 -c 0.1 New\_SVM\_Data/16\_20-trPCA\_01-new.txt 16\_20-rbf01-G0\_1C0\_1.model

./libsvm-3.24/svm-train -t 2 -g 0.5 -r 0 -c 0.1 New\_SVM\_Data/16\_20-trPCA\_01-new.txt 16\_20-rbf01-G1C0\_1.model

./libsvm-3.24/svm-train -t 2 -g 0.005 -r 0 -c 0.1 New\_SVM\_Data/16\_20-trPCA\_01-new.txt 16\_20-rbf01-G10C0\_1.model

./libsvm-3.24/svm-train -t 2 -g 0.00005 -r 0 -c 0.1 New\_SVM\_Data/16\_20-trPCA\_01-new.txt 16\_20-rbf01-G100C0\_1.model

./libsvm-3.24/svm-train -t 2 -g 50 -r 0 -c 1 New\_SVM\_Data/16\_20-trPCA\_01-new.txt 16\_20-rbf01-G0\_1C1.model

./libsvm-3.24/svm-train -t 2 -g 0.5 -r 0 -c 1 New\_SVM\_Data/16\_20-trPCA\_01-new.txt 16\_20-rbf01-G1C1.model

./libsvm-3.24/svm-train -t 2 -g 0.005 -r 0 -c 1 New\_SVM\_Data/16\_20-trPCA\_01-new.txt 16\_20-rbf01-G10C1.model

./libsvm-3.24/svm-train -t 2 -g 0.00005 -r 0 -c 1 New\_SVM\_Data/16\_20-trPCA\_01-new.txt 16\_20-rbf01-G100C1.model

./libsvm-3.24/svm-train -t 2 -g 50 -r 0 -c 10 New\_SVM\_Data/16\_20-trPCA\_01-new.txt 16\_20-rbf01-G0\_1C10.model

./libsvm-3.24/svm-train -t 2 -g 0.5 -r 0 -c 10 New\_SVM\_Data/16\_20-trPCA\_01-new.txt 16\_20-rbf01-G1C10.model

./libsvm-3.24/svm-train -t 2 -g 0.005 -r 0 -c 10 New\_SVM\_Data/16\_20-trPCA\_01-new.txt 16\_20-rbf01-G10C10.model

./libsvm-3.24/svm-train -t 2 -g 0.00005 -r 0 -c 10 New\_SVM\_Data/16\_20-trPCA\_01-new.txt 16\_20-rbf01-G100C10.model

./libsvm-3.24/svm-train -t 2 -g 50 -r 0 -c 100 New\_SVM\_Data/16\_20-trPCA\_01-new.txt 16\_20-rbf01-G0\_1C100.model

./libsvm-3.24/svm-train -t 2 -g 0.5 -r 0 -c 100 New\_SVM\_Data/16\_20-trPCA\_01-new.txt 16\_20-rbf01-G1C100.model

./libsvm-3.24/svm-train -t 2 -g 0.005 -r 0 -c 100 New\_SVM\_Data/16\_20-trPCA\_01-new.txt 16\_20-rbf01-G10C100.model

./libsvm-3.24/svm-train -t 2 -g 0.00005 -r 0 -c 100 New\_SVM\_Data/16\_20-trPCA\_01-new.txt 16\_20-rbf01-G100C100.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 1 -c 0.1 New\_SVM\_Data/16\_20-trPCA\_02-new.txt 16\_20-poly02-D1C0\_1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 2 -c 0.1 New\_SVM\_Data/16\_20-trPCA\_02-new.txt 16\_20-poly02-D2C0\_1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 3 -c 0.1 New\_SVM\_Data/16\_20-trPCA\_02-new.txt 16\_20-poly02-D3C0\_1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 1 -c 1 New\_SVM\_Data/16\_20-trPCA\_02-new.txt 16\_20-poly02-D1C1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 2 -c 1 New\_SVM\_Data/16\_20-trPCA\_02-new.txt 16\_20-poly02-D2C1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 3 -c 1 New\_SVM\_Data/16\_20-trPCA\_02-new.txt 16\_20-poly02-D3C1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 1 -c 10 New\_SVM\_Data/16\_20-trPCA\_02-new.txt 16\_20-poly02-D1C10.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 2 -c 10 New\_SVM\_Data/16\_20-trPCA\_02-new.txt 16\_20-poly02-D2C10.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 3 -c 10 New\_SVM\_Data/16\_20-trPCA\_02-new.txt 16\_20-poly02-D3C10.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 1 -c 100 New\_SVM\_Data/16\_20-trPCA\_02-new.txt 16\_20-poly02-D1C100.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 2 -c 100 New\_SVM\_Data/16\_20-trPCA\_02-new.txt 16\_20-poly02-D2C100.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 3 -c 100 New\_SVM\_Data/16\_20-trPCA\_02-new.txt 16\_20-poly02-D3C100.model

./libsvm-3.24/svm-train -t 2 -g 50 -r 0 -c 0.1 New\_SVM\_Data/16\_20-trPCA\_02-new.txt 16\_20-rbf02-G0\_1C0\_1.model

./libsvm-3.24/svm-train -t 2 -g 0.5 -r 0 -c 0.1 New\_SVM\_Data/16\_20-trPCA\_02-new.txt 16\_20-rbf02-G1C0\_1.model

./libsvm-3.24/svm-train -t 2 -g 0.005 -r 0 -c 0.1 New\_SVM\_Data/16\_20-trPCA\_02-new.txt 16\_20-rbf02-G10C0\_1.model

./libsvm-3.24/svm-train -t 2 -g 0.00005 -r 0 -c 0.1 New\_SVM\_Data/16\_20-trPCA\_02-new.txt 16\_20-rbf02-G100C0\_1.model

./libsvm-3.24/svm-train -t 2 -g 50 -r 0 -c 1 New\_SVM\_Data/16\_20-trPCA\_02-new.txt 16\_20-rbf02-G0\_1C1.model

./libsvm-3.24/svm-train -t 2 -g 0.5 -r 0 -c 1 New\_SVM\_Data/16\_20-trPCA\_02-new.txt 16\_20-rbf02-G1C1.model

./libsvm-3.24/svm-train -t 2 -g 0.005 -r 0 -c 1 New\_SVM\_Data/16\_20-trPCA\_02-new.txt 16\_20-rbf02-G10C1.model

./libsvm-3.24/svm-train -t 2 -g 0.00005 -r 0 -c 1 New\_SVM\_Data/16\_20-trPCA\_02-new.txt 16\_20-rbf02-G100C1.model

./libsvm-3.24/svm-train -t 2 -g 50 -r 0 -c 10 New\_SVM\_Data/16\_20-trPCA\_02-new.txt 16\_20-rbf02-G0\_1C10.model

./libsvm-3.24/svm-train -t 2 -g 0.5 -r 0 -c 10 New\_SVM\_Data/16\_20-trPCA\_02-new.txt 16\_20-rbf02-G1C10.model

./libsvm-3.24/svm-train -t 2 -g 0.005 -r 0 -c 10 New\_SVM\_Data/16\_20-trPCA\_02-new.txt 16\_20-rbf02-G10C10.model

./libsvm-3.24/svm-train -t 2 -g 0.00005 -r 0 -c 10 New\_SVM\_Data/16\_20-trPCA\_02-new.txt 16\_20-rbf02-G100C10.model

./libsvm-3.24/svm-train -t 2 -g 50 -r 0 -c 100 New\_SVM\_Data/16\_20-trPCA\_02-new.txt 16\_20-rbf02-G0\_1C100.model

./libsvm-3.24/svm-train -t 2 -g 0.5 -r 0 -c 100 New\_SVM\_Data/16\_20-trPCA\_02-new.txt 16\_20-rbf02-G1C100.model

./libsvm-3.24/svm-train -t 2 -g 0.005 -r 0 -c 100 New\_SVM\_Data/16\_20-trPCA\_02-new.txt 16\_20-rbf02-G10C100.model

./libsvm-3.24/svm-train -t 2 -g 0.00005 -r 0 -c 100 New\_SVM\_Data/16\_20-trPCA\_02-new.txt 16\_20-rbf02-G100C100.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 1 -c 0.1 New\_SVM\_Data/16\_20-trPCA\_03-new.txt 16\_20-poly03-D1C0\_1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 2 -c 0.1 New\_SVM\_Data/16\_20-trPCA\_03-new.txt 16\_20-poly03-D2C0\_1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 3 -c 0.1 New\_SVM\_Data/16\_20-trPCA\_03-new.txt 16\_20-poly03-D3C0\_1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 1 -c 1 New\_SVM\_Data/16\_20-trPCA\_03-new.txt 16\_20-poly03-D1C1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 2 -c 1 New\_SVM\_Data/16\_20-trPCA\_03-new.txt 16\_20-poly03-D2C1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 3 -c 1 New\_SVM\_Data/16\_20-trPCA\_03-new.txt 16\_20-poly03-D3C1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 1 -c 10 New\_SVM\_Data/16\_20-trPCA\_03-new.txt 16\_20-poly03-D1C10.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 2 -c 10 New\_SVM\_Data/16\_20-trPCA\_03-new.txt 16\_20-poly03-D2C10.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 3 -c 10 New\_SVM\_Data/16\_20-trPCA\_03-new.txt 16\_20-poly03-D3C10.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 1 -c 100 New\_SVM\_Data/16\_20-trPCA\_03-new.txt 16\_20-poly03-D1C100.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 2 -c 100 New\_SVM\_Data/16\_20-trPCA\_03-new.txt 16\_20-poly03-D2C100.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 3 -c 100 New\_SVM\_Data/16\_20-trPCA\_03-new.txt 16\_20-poly03-D3C100.model

./libsvm-3.24/svm-train -t 2 -g 50 -r 0 -c 0.1 New\_SVM\_Data/16\_20-trPCA\_03-new.txt 16\_20-rbf03-G0\_1C0\_1.model

./libsvm-3.24/svm-train -t 2 -g 0.5 -r 0 -c 0.1 New\_SVM\_Data/16\_20-trPCA\_03-new.txt 16\_20-rbf03-G1C0\_1.model

./libsvm-3.24/svm-train -t 2 -g 0.005 -r 0 -c 0.1 New\_SVM\_Data/16\_20-trPCA\_03-new.txt 16\_20-rbf03-G10C0\_1.model

./libsvm-3.24/svm-train -t 2 -g 0.00005 -r 0 -c 0.1 New\_SVM\_Data/16\_20-trPCA\_03-new.txt 16\_20-rbf03-G100C0\_1.model

./libsvm-3.24/svm-train -t 2 -g 50 -r 0 -c 1 New\_SVM\_Data/16\_20-trPCA\_03-new.txt 16\_20-rbf03-G0\_1C1.model

./libsvm-3.24/svm-train -t 2 -g 0.5 -r 0 -c 1 New\_SVM\_Data/16\_20-trPCA\_03-new.txt 16\_20-rbf03-G1C1.model

./libsvm-3.24/svm-train -t 2 -g 0.005 -r 0 -c 1 New\_SVM\_Data/16\_20-trPCA\_03-new.txt 16\_20-rbf03-G10C1.model

./libsvm-3.24/svm-train -t 2 -g 0.00005 -r 0 -c 1 New\_SVM\_Data/16\_20-trPCA\_03-new.txt 16\_20-rbf03-G100C1.model

./libsvm-3.24/svm-train -t 2 -g 50 -r 0 -c 10 New\_SVM\_Data/16\_20-trPCA\_03-new.txt 16\_20-rbf03-G0\_1C10.model

./libsvm-3.24/svm-train -t 2 -g 0.5 -r 0 -c 10 New\_SVM\_Data/16\_20-trPCA\_03-new.txt 16\_20-rbf03-G1C10.model

./libsvm-3.24/svm-train -t 2 -g 0.005 -r 0 -c 10 New\_SVM\_Data/16\_20-trPCA\_03-new.txt 16\_20-rbf03-G10C10.model

./libsvm-3.24/svm-train -t 2 -g 0.00005 -r 0 -c 10 New\_SVM\_Data/16\_20-trPCA\_03-new.txt 16\_20-rbf03-G100C10.model

./libsvm-3.24/svm-train -t 2 -g 50 -r 0 -c 100 New\_SVM\_Data/16\_20-trPCA\_03-new.txt 16\_20-rbf03-G0\_1C100.model

./libsvm-3.24/svm-train -t 2 -g 0.5 -r 0 -c 100 New\_SVM\_Data/16\_20-trPCA\_03-new.txt 16\_20-rbf03-G1C100.model

./libsvm-3.24/svm-train -t 2 -g 0.005 -r 0 -c 100 New\_SVM\_Data/16\_20-trPCA\_03-new.txt 16\_20-rbf03-G10C100.model

./libsvm-3.24/svm-train -t 2 -g 0.00005 -r 0 -c 100 New\_SVM\_Data/16\_20-trPCA\_03-new.txt 16\_20-rbf03-G100C100.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 1 -c 0.1 New\_SVM\_Data/48\_60-trPCA\_01-new.txt 48\_60-poly01-D1C0\_1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 2 -c 0.1 New\_SVM\_Data/48\_60-trPCA\_01-new.txt 48\_60-poly01-D2C0\_1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 3 -c 0.1 New\_SVM\_Data/48\_60-trPCA\_01-new.txt 48\_60-poly01-D3C0\_1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 1 -c 1 New\_SVM\_Data/48\_60-trPCA\_01-new.txt 48\_60-poly01-D1C1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 2 -c 1 New\_SVM\_Data/48\_60-trPCA\_01-new.txt 48\_60-poly01-D2C1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 3 -c 1 New\_SVM\_Data/48\_60-trPCA\_01-new.txt 48\_60-poly01-D3C1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 1 -c 10 New\_SVM\_Data/48\_60-trPCA\_01-new.txt 48\_60-poly01-D1C10.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 2 -c 10 New\_SVM\_Data/48\_60-trPCA\_01-new.txt 48\_60-poly01-D2C10.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 3 -c 10 New\_SVM\_Data/48\_60-trPCA\_01-new.txt 48\_60-poly01-D3C10.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 1 -c 100 New\_SVM\_Data/48\_60-trPCA\_01-new.txt 48\_60-poly01-D1C100.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 2 -c 100 New\_SVM\_Data/48\_60-trPCA\_01-new.txt 48\_60-poly01-D2C100.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 3 -c 100 New\_SVM\_Data/48\_60-trPCA\_01-new.txt 48\_60-poly01-D3C100.model

./libsvm-3.24/svm-train -t 2 -g 50 -r 0 -c 0.1 New\_SVM\_Data/48\_60-trPCA\_01-new.txt 48\_60-rbf01-G0\_1C0\_1.model

./libsvm-3.24/svm-train -t 2 -g 0.5 -r 0 -c 0.1 New\_SVM\_Data/48\_60-trPCA\_01-new.txt 48\_60-rbf01-G1C0\_1.model

./libsvm-3.24/svm-train -t 2 -g 0.005 -r 0 -c 0.1 New\_SVM\_Data/48\_60-trPCA\_01-new.txt 48\_60-rbf01-G1C0\_1.model

./libsvm-3.24/svm-train -t 2 -g 0.00005 -r 0 -c 0.1 New\_SVM\_Data/48\_60-trPCA\_01-new.txt 48\_60-rbf01-G1C0\_1.model

./libsvm-3.24/svm-train -t 2 -g 50 -r 0 -c 1 New\_SVM\_Data/48\_60-trPCA\_01-new.txt 48\_60-rbf01-G0\_1C1.model

./libsvm-3.24/svm-train -t 2 -g 0.5 -r 0 -c 1 New\_SVM\_Data/48\_60-trPCA\_01-new.txt 48\_60-rbf01-G1C1.model

./libsvm-3.24/svm-train -t 2 -g 0.005 -r 0 -c 1 New\_SVM\_Data/48\_60-trPCA\_01-new.txt 48\_60-rbf01-G10C1.model

./libsvm-3.24/svm-train -t 2 -g 0.00005 -r 0 -c 1 New\_SVM\_Data/48\_60-trPCA\_01-new.txt 48\_60-rbf01-G100C1.model

./libsvm-3.24/svm-train -t 2 -g 50 -r 0 -c 10 New\_SVM\_Data/48\_60-trPCA\_01-new.txt 48\_60-rbf01-G0\_1C10.model

./libsvm-3.24/svm-train -t 2 -g 0.5 -r 0 -c 10 New\_SVM\_Data/48\_60-trPCA\_01-new.txt 48\_60-rbf01-G1C10.model

./libsvm-3.24/svm-train -t 2 -g 0.005 -r 0 -c 10 New\_SVM\_Data/48\_60-trPCA\_01-new.txt 48\_60-rbf01-G10C10.model

./libsvm-3.24/svm-train -t 2 -g 0.00005 -r 0 -c 10 New\_SVM\_Data/48\_60-trPCA\_01-new.txt 48\_60-rbf01-G100C10.model

./libsvm-3.24/svm-train -t 2 -g 50 -r 0 -c 100 New\_SVM\_Data/48\_60-trPCA\_01-new.txt 48\_60-rbf01-G0\_1C100.model

./libsvm-3.24/svm-train -t 2 -g 0.5 -r 0 -c 100 New\_SVM\_Data/48\_60-trPCA\_01-new.txt 48\_60-rbf01-G1C100.model

./libsvm-3.24/svm-train -t 2 -g 0.005 -r 0 -c 100 New\_SVM\_Data/48\_60-trPCA\_01-new.txt 48\_60-rbf01-G10C100.model

./libsvm-3.24/svm-train -t 2 -g 0.00005 -r 0 -c 100 New\_SVM\_Data/48\_60-trPCA\_01-new.txt 48\_60-rbf01-G100C100.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 1 -c 0.1 New\_SVM\_Data/48\_60-trPCA\_02-new.txt 48\_60-poly02-D1C0\_1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 2 -c 0.1 New\_SVM\_Data/48\_60-trPCA\_02-new.txt 48\_60-poly02-D2C0\_1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 3 -c 0.1 New\_SVM\_Data/48\_60-trPCA\_02-new.txt 48\_60-poly02-D3C0\_1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 1 -c 1 New\_SVM\_Data/48\_60-trPCA\_02-new.txt 48\_60-poly02-D1C1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 2 -c 1 New\_SVM\_Data/48\_60-trPCA\_02-new.txt 48\_60-poly02-D2C1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 3 -c 1 New\_SVM\_Data/48\_60-trPCA\_02-new.txt 48\_60-poly02-D3C1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 1 -c 10 New\_SVM\_Data/48\_60-trPCA\_02-new.txt 48\_60-poly02-D1C10.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 2 -c 10 New\_SVM\_Data/48\_60-trPCA\_02-new.txt 48\_60-poly02-D2C10.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 3 -c 10 New\_SVM\_Data/48\_60-trPCA\_02-new.txt 48\_60-poly02-D3C10.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 1 -c 100 New\_SVM\_Data/48\_60-trPCA\_02-new.txt 48\_60-poly02-D1C100.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 2 -c 100 New\_SVM\_Data/48\_60-trPCA\_02-new.txt 48\_60-poly02-D2C100.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 3 -c 100 New\_SVM\_Data/48\_60-trPCA\_02-new.txt 48\_60-poly02-D3C100.model

./libsvm-3.24/svm-train -t 2 -g 50 -r 0 -c 0.1 New\_SVM\_Data/48\_60-trPCA\_02-new.txt 48\_60-rbf02-G0\_1C0\_1.model

./libsvm-3.24/svm-train -t 2 -g 0.5 -r 0 -c 0.1 New\_SVM\_Data/48\_60-trPCA\_02-new.txt 48\_60-rbf02-G1C0\_1.model

./libsvm-3.24/svm-train -t 2 -g 0.005 -r 0 -c 0.1 New\_SVM\_Data/48\_60-trPCA\_02-new.txt 48\_60-rbf02-G10C0\_1.model

./libsvm-3.24/svm-train -t 2 -g 0.00005 -r 0 -c 0.1 New\_SVM\_Data/48\_60-trPCA\_02-new.txt 48\_60-rbf02-G100C0\_1.model

./libsvm-3.24/svm-train -t 2 -g 50 -r 0 -c 1 New\_SVM\_Data/48\_60-trPCA\_02-new.txt 48\_60-rbf02-G0\_1C1.model

./libsvm-3.24/svm-train -t 2 -g 0.5 -r 0 -c 1 New\_SVM\_Data/48\_60-trPCA\_02-new.txt 48\_60-rbf02-G1C1.model

./libsvm-3.24/svm-train -t 2 -g 0.005 -r 0 -c 1 New\_SVM\_Data/48\_60-trPCA\_02-new.txt 48\_60-rbf02-G10C1.model

./libsvm-3.24/svm-train -t 2 -g 0.00005 -r 0 -c 1 New\_SVM\_Data/48\_60-trPCA\_02-new.txt 48\_60-rbf02-G100C1.model

./libsvm-3.24/svm-train -t 2 -g 50 -r 0 -c 10 New\_SVM\_Data/48\_60-trPCA\_02-new.txt 48\_60-rbf02-G0\_1C10.model

./libsvm-3.24/svm-train -t 2 -g 0.5 -r 0 -c 10 New\_SVM\_Data/48\_60-trPCA\_02-new.txt 48\_60-rbf02-G1C10.model

./libsvm-3.24/svm-train -t 2 -g 0.005 -r 0 -c 10 New\_SVM\_Data/48\_60-trPCA\_02-new.txt 48\_60-rbf02-G10C10.model

./libsvm-3.24/svm-train -t 2 -g 0.00005 -r 0 -c 10 New\_SVM\_Data/48\_60-trPCA\_02-new.txt 48\_60-rbf02-G100C10.model

./libsvm-3.24/svm-train -t 2 -g 50 -r 0 -c 100 New\_SVM\_Data/48\_60-trPCA\_02-new.txt 48\_60-rbf02-G0\_1C100.model

./libsvm-3.24/svm-train -t 2 -g 0.5 -r 0 -c 100 New\_SVM\_Data/48\_60-trPCA\_02-new.txt 48\_60-rbf02-G1C100.model

./libsvm-3.24/svm-train -t 2 -g 0.005 -r 0 -c 100 New\_SVM\_Data/48\_60-trPCA\_02-new.txt 48\_60-rbf02-G10C100.model

./libsvm-3.24/svm-train -t 2 -g 0.00005 -r 0 -c 100 New\_SVM\_Data/48\_60-trPCA\_02-new.txt 48\_60-rbf02-G100C100.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 1 -c 0.1 New\_SVM\_Data/48\_60-trPCA\_03-new.txt 48\_60-poly03-D1C0\_1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 2 -c 0.1 New\_SVM\_Data/48\_60-trPCA\_03-new.txt 48\_60-poly03-D2C0\_1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 3 -c 0.1 New\_SVM\_Data/48\_60-trPCA\_03-new.txt 48\_60-poly03-D3C0\_1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 1 -c 1 New\_SVM\_Data/48\_60-trPCA\_03-new.txt 48\_60-poly03-D1C1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 2 -c 1 New\_SVM\_Data/48\_60-trPCA\_03-new.txt 48\_60-poly03-D2C1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 3 -c 1 New\_SVM\_Data/48\_60-trPCA\_03-new.txt 48\_60-poly03-D3C1.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 1 -c 10 New\_SVM\_Data/48\_60-trPCA\_03-new.txt 48\_60-poly03-D1C10.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 2 -c 10 New\_SVM\_Data/48\_60-trPCA\_03-new.txt 48\_60-poly03-D2C10.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 3 -c 10 New\_SVM\_Data/48\_60-trPCA\_03-new.txt 48\_60-poly03-D3C10.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 1 -c 100 New\_SVM\_Data/48\_60-trPCA\_03-new.txt 48\_60-poly03-D1C100.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 2 -c 100 New\_SVM\_Data/48\_60-trPCA\_03-new.txt 48\_60-poly03-D2C100.model

./libsvm-3.24/svm-train -t 1 -g 1 -r 0 -d 3 -c 100 New\_SVM\_Data/48\_60-trPCA\_03-new.txt 48\_60-poly03-D3C100.model

./libsvm-3.24/svm-train -t 2 -g 50 -r 0 -c 0.1 New\_SVM\_Data/48\_60-trPCA\_03-new.txt 48\_60-rbf03-G0\_1C0\_1.model

./libsvm-3.24/svm-train -t 2 -g 0.5 -r 0 -c 0.1 New\_SVM\_Data/48\_60-trPCA\_03-new.txt 48\_60-rbf03-G1C0\_1.model

./libsvm-3.24/svm-train -t 2 -g 0.005 -r 0 -c 0.1 New\_SVM\_Data/48\_60-trPCA\_03-new.txt 48\_60-rbf03-G10C0\_1.model

./libsvm-3.24/svm-train -t 2 -g 0.00005 -r 0 -c 0.1 New\_SVM\_Data/48\_60-trPCA\_03-new.txt 48\_60-rbf03-G100C0\_1.model

./libsvm-3.24/svm-train -t 2 -g 50 -r 0 -c 1 New\_SVM\_Data/48\_60-trPCA\_03-new.txt 48\_60-rbf03-G0\_1C1.model

./libsvm-3.24/svm-train -t 2 -g 0.5 -r 0 -c 1 New\_SVM\_Data/48\_60-trPCA\_03-new.txt 48\_60-rbf03-G1C1.model

./libsvm-3.24/svm-train -t 2 -g 0.005 -r 0 -c 1 New\_SVM\_Data/48\_60-trPCA\_03-new.txt 48\_60-rbf03-G10C1.model

./libsvm-3.24/svm-train -t 2 -g 0.00005 -r 0 -c 1 New\_SVM\_Data/48\_60-trPCA\_03-new.txt 48\_60-rbf03-G100C1.model

./libsvm-3.24/svm-train -t 2 -g 50 -r 0 -c 10 New\_SVM\_Data/48\_60-trPCA\_03-new.txt 48\_60-rbf03-G0\_1C10.model

./libsvm-3.24/svm-train -t 2 -g 0.5 -r 0 -c 10 New\_SVM\_Data/48\_60-trPCA\_03-new.txt 48\_60-rbf03-G1C10.model

./libsvm-3.24/svm-train -t 2 -g 0.005 -r 0 -c 10 New\_SVM\_Data/48\_60-trPCA\_03-new.txt 48\_60-rbf03-G10C10.model

./libsvm-3.24/svm-train -t 2 -g 0.00005 -r 0 -c 10 New\_SVM\_Data/48\_60-trPCA\_03-new.txt 48\_60-rbf03-G100C10.model

./libsvm-3.24/svm-train -t 2 -g 50 -r 0 -c 100 New\_SVM\_Data/48\_60-trPCA\_03-new.txt 48\_60-rbf03-G0\_1C100.model

./libsvm-3.24/svm-train -t 2 -g 0.5 -r 0 -c 100 New\_SVM\_Data/48\_60-trPCA\_03-new.txt 48\_60-rbf03-G1C100.model

./libsvm-3.24/svm-train -t 2 -g 0.005 -r 0 -c 100 New\_SVM\_Data/48\_60-trPCA\_03-new.txt 48\_60-rbf03-G10C100.model

./libsvm-3.24/svm-train -t 2 -g 0.00005 -r 0 -c 100 New\_SVM\_Data/48\_60-trPCA\_03-new.txt 48\_60-rbf03-G100C100.model

PA4-svm-test.sh

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_01-new.txt 16\_20-poly01-D1C0\_1.model 16\_20-poly01-D1C0\_1.output &> 16\_20-poly01-D1C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_01-new.txt 16\_20-poly01-D2C0\_1.model 16\_20-poly01-D2C0\_1.output &> 16\_20-poly01-D2C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_01-new.txt 16\_20-poly01-D3C0\_1.model 16\_20-poly01-D3C0\_1.output &> 16\_20-poly01-D3C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_01-new.txt 16\_20-poly01-D1C1.model 16\_20-poly01-D1C1.output &> 16\_20-poly01-D1C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_01-new.txt 16\_20-poly01-D2C1.model 16\_20-poly01-D2C1.output &> 16\_20-poly01-D2C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_01-new.txt 16\_20-poly01-D3C1.model 16\_20-poly01-D3C1.output &> 16\_20-poly01-D3C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_01-new.txt 16\_20-poly01-D1C10.model 16\_20-poly01-D1C10.output &> 16\_20-poly01-D1C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_01-new.txt 16\_20-poly01-D2C10.model 16\_20-poly01-D2C10.output &> 16\_20-poly01-D2C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_01-new.txt 16\_20-poly01-D3C10.model 16\_20-poly01-D3C10.output &> 16\_20-poly01-D3C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_01-new.txt 16\_20-poly01-D1C100.model 16\_20-poly01-D1C100.output &> 16\_20-poly01-D1C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_01-new.txt 16\_20-poly01-D2C100.model 16\_20-poly01-D2C100.output &> 16\_20-poly01-D2C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_01-new.txt 16\_20-poly01-D3C100.model 16\_20-poly01-D3C100.output &> 16\_20-poly01-D3C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_01-new.txt 16\_20-rbf01-G0\_1C0\_1.model 16\_20-rbf01-G0\_1C0\_1.output &> 16\_20-rbf01-G0\_1C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_01-new.txt 16\_20-rbf01-G1C0\_1.model 16\_20-rbf01-G1C0\_1.output &> 16\_20-rbf01-G1C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_01-new.txt 16\_20-rbf01-G10C0\_1.model 16\_20-rbf01-G10C0\_1.output &> 16\_20-rbf01-G10C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_01-new.txt 16\_20-rbf01-G100C0\_1.model 16\_20-rbf01-G100C0\_1.output &> 16\_20-rbf01-G100C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_01-new.txt 16\_20-rbf01-G0\_1C1.model 16\_20-rbf01-G0\_1C1.output &> 16\_20-rbf01-G0\_1C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_01-new.txt 16\_20-rbf01-G1C1.model 16\_20-rbf01-G1C1.output &> 16\_20-rbf01-G1C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_01-new.txt 16\_20-rbf01-G10C1.model 16\_20-rbf01-G10C1.output &> 16\_20-rbf01-G10C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_01-new.txt 16\_20-rbf01-G100C1.model 16\_20-rbf01-G100C1.output &> 16\_20-rbf01-G100C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_01-new.txt 16\_20-rbf01-G0\_1C10.model 16\_20-rbf01-G0\_1C10.output &> 16\_20-rbf01-G0\_1C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_01-new.txt 16\_20-rbf01-G1C10.model 16\_20-rbf01-G1C10.output &> 16\_20-rbf01-G1C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_01-new.txt 16\_20-rbf01-G10C10.model 16\_20-rbf01-G10C10.output &> 16\_20-rbf01-G10C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_01-new.txt 16\_20-rbf01-G100C10.model 16\_20-rbf01-G100C10.output &> 16\_20-rbf01-G100C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_01-new.txt 16\_20-rbf01-G0\_1C100.model 16\_20-rbf01-G0\_1C100.output &> 16\_20-rbf01-G0\_1C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_01-new.txt 16\_20-rbf01-G1C100.model 16\_20-rbf01-G1C100.output &> 16\_20-rbf01-G1C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_01-new.txt 16\_20-rbf01-G10C100.model 16\_20-rbf01-G10C100.output &> 16\_20-rbf01-G10C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_01-new.txt 16\_20-rbf01-G100C100.model 16\_20-rbf01-G100C100.output &> 16\_20-rbf01-G100C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_02-new.txt 16\_20-poly02-D1C0\_1.model 16\_20-poly02-D1C0\_1.output &> 16\_20-poly02-D1C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_02-new.txt 16\_20-poly02-D2C0\_1.model 16\_20-poly02-D2C0\_1.output &> 16\_20-poly02-D2C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_02-new.txt 16\_20-poly02-D3C0\_1.model 16\_20-poly02-D3C0\_1.output &> 16\_20-poly02-D3C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_02-new.txt 16\_20-poly02-D1C1.model 16\_20-poly02-D1C1.output &> 16\_20-poly02-D1C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_02-new.txt 16\_20-poly02-D2C1.model 16\_20-poly02-D2C1.output &> 16\_20-poly02-D2C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_02-new.txt 16\_20-poly02-D3C1.model 16\_20-poly02-D3C1.output &> 16\_20-poly02-D3C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_02-new.txt 16\_20-poly02-D1C10.model 16\_20-poly02-D1C10.output &> 16\_20-poly02-D1C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_02-new.txt 16\_20-poly02-D2C10.model 16\_20-poly02-D2C10.output &> 16\_20-poly02-D2C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_02-new.txt 16\_20-poly02-D3C10.model 16\_20-poly02-D3C10.output &> 16\_20-poly02-D3C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_02-new.txt 16\_20-poly02-D1C100.model 16\_20-poly02-D1C100.output &> 16\_20-poly02-D1C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_02-new.txt 16\_20-poly02-D2C100.model 16\_20-poly02-D2C100.output &> 16\_20-poly02-D2C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_02-new.txt 16\_20-poly02-D3C100.model 16\_20-poly02-D3C100.output &> 16\_20-poly02-D3C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_02-new.txt 16\_20-rbf02-G0\_1C0\_1.model 16\_20-rbf02-G0\_1C0\_1.output &> 16\_20-rbf02-G0\_1C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_02-new.txt 16\_20-rbf02-G1C0\_1.model 16\_20-rbf02-G1C0\_1.output &> 16\_20-rbf02-G1C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_02-new.txt 16\_20-rbf02-G10C0\_1.model 16\_20-rbf02-G10C0\_1.output &> 16\_20-rbf02-G10C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_02-new.txt 16\_20-rbf02-G100C0\_1.model 16\_20-rbf02-G100C0\_1.output &> 16\_20-rbf02-G100C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_02-new.txt 16\_20-rbf02-G0\_1C1.model 16\_20-rbf02-G0\_1C1.output &> 16\_20-rbf02-G0\_1C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_02-new.txt 16\_20-rbf02-G1C1.model 16\_20-rbf02-G1C1.output &> 16\_20-rbf02-G1C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_02-new.txt 16\_20-rbf02-G10C1.model 16\_20-rbf02-G10C1.output &> 16\_20-rbf02-G10C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_02-new.txt 16\_20-rbf02-G100C1.model 16\_20-rbf02-G100C1.output &> 16\_20-rbf02-G100C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_02-new.txt 16\_20-rbf02-G0\_1C10.model 16\_20-rbf02-G0\_1C10.output &> 16\_20-rbf02-G0\_1C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_02-new.txt 16\_20-rbf02-G1C10.model 16\_20-rbf02-G1C10.output &> 16\_20-rbf02-G1C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_02-new.txt 16\_20-rbf02-G10C10.model 16\_20-rbf02-G10C10.output &> 16\_20-rbf02-G10C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_02-new.txt 16\_20-rbf02-G100C10.model 16\_20-rbf02-G100C10.output &> 16\_20-rbf02-G100C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_02-new.txt 16\_20-rbf02-G0\_1C100.model 16\_20-rbf02-G0\_1C100.output &> 16\_20-rbf02-G0\_1C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_02-new.txt 16\_20-rbf02-G1C100.model 16\_20-rbf02-G1C100.output &> 16\_20-rbf02-G1C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_02-new.txt 16\_20-rbf02-G10C100.model 16\_20-rbf02-G10C100.output &> 16\_20-rbf02-G10C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_02-new.txt 16\_20-rbf02-G100C100.model 16\_20-rbf02-G100C100.output &> 16\_20-rbf02-G100C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_03-new.txt 16\_20-poly03-D1C0\_1.model 16\_20-poly03-D1C0\_1.output &> 16\_20-poly03-D1C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_03-new.txt 16\_20-poly03-D2C0\_1.model 16\_20-poly03-D2C0\_1.output &> 16\_20-poly03-D2C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_03-new.txt 16\_20-poly03-D3C0\_1.model 16\_20-poly03-D3C0\_1.output &> 16\_20-poly03-D3C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_03-new.txt 16\_20-poly03-D1C1.model 16\_20-poly03-D1C1.output &> 16\_20-poly03-D1C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_03-new.txt 16\_20-poly03-D2C1.model 16\_20-poly03-D2C1.output &> 16\_20-poly03-D2C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_03-new.txt 16\_20-poly03-D3C1.model 16\_20-poly03-D3C1.output &> 16\_20-poly03-D3C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_03-new.txt 16\_20-poly03-D1C10.model 16\_20-poly03-D1C10.output &> 16\_20-poly03-D1C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_03-new.txt 16\_20-poly03-D2C10.model 16\_20-poly03-D2C10.output &> 16\_20-poly03-D2C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_03-new.txt 16\_20-poly03-D3C10.model 16\_20-poly03-D3C10.output &> 16\_20-poly03-D3C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_03-new.txt 16\_20-poly03-D1C100.model 16\_20-poly03-D1C100.output &> 16\_20-poly03-D1C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_03-new.txt 16\_20-poly03-D2C100.model 16\_20-poly03-D2C100.output &> 16\_20-poly03-D2C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_03-new.txt 16\_20-poly03-D3C100.model 16\_20-poly03-D3C100.output &> 16\_20-poly03-D3C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_03-new.txt 16\_20-rbf03-G0\_1C0\_1.model 16\_20-rbf03-G0\_1C0\_1.output &> 16\_20-rbf03-G0\_1C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_03-new.txt 16\_20-rbf03-G1C0\_1.model 16\_20-rbf03-G1C0\_1.output &> 16\_20-rbf03-G1C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_03-new.txt 16\_20-rbf03-G10C0\_1.model 16\_20-rbf03-G10C0\_1.output &> 16\_20-rbf03-G10C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_03-new.txt 16\_20-rbf03-G100C0\_1.model 16\_20-rbf03-G100C0\_1.output &> 16\_20-rbf03-G100C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_03-new.txt 16\_20-rbf03-G0\_1C1.model 16\_20-rbf03-G0\_1C1.output &> 16\_20-rbf03-G0\_1C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_03-new.txt 16\_20-rbf03-G1C1.model 16\_20-rbf03-G1C1.output &> 16\_20-rbf03-G1C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_03-new.txt 16\_20-rbf03-G10C1.model 16\_20-rbf03-G10C1.output &> 16\_20-rbf03-G10C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_03-new.txt 16\_20-rbf03-G100C1.model 16\_20-rbf03-G100C1.output &> 16\_20-rbf03-G100C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_03-new.txt 16\_20-rbf03-G0\_1C10.model 16\_20-rbf03-G0\_1C10.output &> 16\_20-rbf03-G0\_1C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_03-new.txt 16\_20-rbf03-G1C10.model 16\_20-rbf03-G1C10.output &> 16\_20-rbf03-G1C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_03-new.txt 16\_20-rbf03-G10C10.model 16\_20-rbf03-G10C10.output &> 16\_20-rbf03-G10C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_03-new.txt 16\_20-rbf03-G100C10.model 16\_20-rbf03-G100C10.output &> 16\_20-rbf03-G100C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_03-new.txt 16\_20-rbf03-G0\_1C100.model 16\_20-rbf03-G0\_1C100.output &> 16\_20-rbf03-G0\_1C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_03-new.txt 16\_20-rbf03-G1C100.model 16\_20-rbf03-G1C100.output &> 16\_20-rbf03-G1C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_03-new.txt 16\_20-rbf03-G10C100.model 16\_20-rbf03-G10C100.output &> 16\_20-rbf03-G10C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/16\_20-tsPCA\_03-new.txt 16\_20-rbf03-G100C100.model 16\_20-rbf03-G100C100.output &> 16\_20-rbf03-G100C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_01-new.txt 48\_60-poly01-D1C0\_1.model 48\_60-poly01-D1C0\_1.output &> 48\_60-poly01-D1C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_01-new.txt 48\_60-poly01-D2C0\_1.model 48\_60-poly01-D2C0\_1.output &> 48\_60-poly01-D2C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_01-new.txt 48\_60-poly01-D3C0\_1.model 48\_60-poly01-D3C0\_1.output &> 48\_60-poly01-D3C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_01-new.txt 48\_60-poly01-D1C1.model 48\_60-poly01-D1C1.output &> 48\_60-poly01-D1C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_01-new.txt 48\_60-poly01-D2C1.model 48\_60-poly01-D2C1.output &> 48\_60-poly01-D2C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_01-new.txt 48\_60-poly01-D3C1.model 48\_60-poly01-D3C1.output &> 48\_60-poly01-D3C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_01-new.txt 48\_60-poly01-D1C10.model 48\_60-poly01-D1C10.output &> 48\_60-poly01-D1C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_01-new.txt 48\_60-poly01-D2C10.model 48\_60-poly01-D2C10.output &> 48\_60-poly01-D2C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_01-new.txt 48\_60-poly01-D3C10.model 48\_60-poly01-D3C10.output &> 48\_60-poly01-D3C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_01-new.txt 48\_60-poly01-D1C100.model 48\_60-poly01-D1C100.output &> 48\_60-poly01-D1C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_01-new.txt 48\_60-poly01-D2C100.model 48\_60-poly01-D2C100.output &> 48\_60-poly01-D2C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_01-new.txt 48\_60-poly01-D3C100.model 48\_60-poly01-D3C100.output &> 48\_60-poly01-D3C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_01-new.txt 48\_60-rbf01-G0\_1C0\_1.model 48\_60-rbf01-G0\_1C0\_1.output &> 48\_60-rbf01-G0\_1C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_01-new.txt 48\_60-rbf01-G1C0\_1.model 48\_60-rbf01-G1C0\_1.output &> 48\_60-rbf01-G1C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_01-new.txt 48\_60-rbf01-G10C0\_1.model 48\_60-rbf01-G10C0\_1.output &> 48\_60-rbf01-G10C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_01-new.txt 48\_60-rbf01-G100C0\_1.model 48\_60-rbf01-G100C0\_1.output &> 48\_60-rbf01-G100C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_01-new.txt 48\_60-rbf01-G0\_1C1.model 48\_60-rbf01-G0\_1C1.output &> 48\_60-rbf01-G0\_1C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_01-new.txt 48\_60-rbf01-G1C1.model 48\_60-rbf01-G1C1.output &> 48\_60-rbf01-G1C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_01-new.txt 48\_60-rbf01-G10C1.model 48\_60-rbf01-G10C1.output &> 48\_60-rbf01-G10C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_01-new.txt 48\_60-rbf01-G100C1.model 48\_60-rbf01-G100C1.output &> 48\_60-rbf01-G100C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_01-new.txt 48\_60-rbf01-G0\_1C10.model 48\_60-rbf01-G0\_1C10.output &> 48\_60-rbf01-G0\_1C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_01-new.txt 48\_60-rbf01-G1C10.model 48\_60-rbf01-G1C10.output &> 48\_60-rbf01-G1C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_01-new.txt 48\_60-rbf01-G10C10.model 48\_60-rbf01-G10C10.output &> 48\_60-rbf01-G10C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_01-new.txt 48\_60-rbf01-G100C10.model 48\_60-rbf01-G100C10.output &> 48\_60-rbf01-G100C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_01-new.txt 48\_60-rbf01-G0\_1C100.model 48\_60-rbf01-G0\_1C100.output &> 48\_60-rbf01-G0\_1C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_01-new.txt 48\_60-rbf01-G1C100.model 48\_60-rbf01-G1C100.output &> 48\_60-rbf01-G1C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_01-new.txt 48\_60-rbf01-G10C100.model 48\_60-rbf01-G10C100.output &> 48\_60-rbf01-G10C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_01-new.txt 48\_60-rbf01-G100C100.model 48\_60-rbf01-G100C100.output &> 48\_60-rbf01-G100C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_02-new.txt 48\_60-poly02-D1C0\_1.model 48\_60-poly02-D1C0\_1.output &> 48\_60-poly02-D1C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_02-new.txt 48\_60-poly02-D2C0\_1.model 48\_60-poly02-D2C0\_1.output &> 48\_60-poly02-D2C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_02-new.txt 48\_60-poly02-D3C0\_1.model 48\_60-poly02-D3C0\_1.output &> 48\_60-poly02-D3C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_02-new.txt 48\_60-poly02-D1C1.model 48\_60-poly02-D1C1.output &> 48\_60-poly02-D1C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_02-new.txt 48\_60-poly02-D2C1.model 48\_60-poly02-D2C1.output &> 48\_60-poly02-D2C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_02-new.txt 48\_60-poly02-D3C1.model 48\_60-poly02-D3C1.output &> 48\_60-poly02-D3C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_02-new.txt 48\_60-poly02-D1C10.model 48\_60-poly02-D1C10.output &> 48\_60-poly02-D1C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_02-new.txt 48\_60-poly02-D2C10.model 48\_60-poly02-D2C10.output &> 48\_60-poly02-D2C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_02-new.txt 48\_60-poly02-D3C10.model 48\_60-poly02-D3C10.output &> 48\_60-poly02-D3C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_02-new.txt 48\_60-poly02-D1C100.model 48\_60-poly02-D1C100.output &> 48\_60-poly02-D1C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_02-new.txt 48\_60-poly02-D2C100.model 48\_60-poly02-D2C100.output &> 48\_60-poly02-D2C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_02-new.txt 48\_60-poly02-D3C100.model 48\_60-poly02-D3C100.output &> 48\_60-poly02-D3C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_02-new.txt 48\_60-rbf02-G0\_1C0\_1.model 48\_60-rbf02-G0\_1C0\_1.output &> 48\_60-rbf02-G0\_1C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_02-new.txt 48\_60-rbf02-G1C0\_1.model 48\_60-rbf02-G1C0\_1.output &> 48\_60-rbf02-G1C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_02-new.txt 48\_60-rbf02-G10C0\_1.model 48\_60-rbf02-G10C0\_1.output &> 48\_60-rbf02-G10C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_02-new.txt 48\_60-rbf02-G100C0\_1.model 48\_60-rbf02-G100C0\_1.output &> 48\_60-rbf02-G100C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_02-new.txt 48\_60-rbf02-G0\_1C1.model 48\_60-rbf02-G0\_1C1.output &> 48\_60-rbf02-G0\_1C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_02-new.txt 48\_60-rbf02-G1C1.model 48\_60-rbf02-G1C1.output &> 48\_60-rbf02-G1C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_02-new.txt 48\_60-rbf02-G10C1.model 48\_60-rbf02-G10C1.output &> 48\_60-rbf02-G10C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_02-new.txt 48\_60-rbf02-G100C1.model 48\_60-rbf02-G100C1.output &> 48\_60-rbf02-G100C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_02-new.txt 48\_60-rbf02-G0\_1C10.model 48\_60-rbf02-G0\_1C10.output &> 48\_60-rbf02-G0\_1C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_02-new.txt 48\_60-rbf02-G1C10.model 48\_60-rbf02-G1C10.output &> 48\_60-rbf02-G1C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_02-new.txt 48\_60-rbf02-G10C10.model 48\_60-rbf02-G10C10.output &> 48\_60-rbf02-G10C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_02-new.txt 48\_60-rbf02-G100C10.model 48\_60-rbf02-G100C10.output &> 48\_60-rbf02-G100C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_02-new.txt 48\_60-rbf02-G0\_1C100.model 48\_60-rbf02-G0\_1C100.output &> 48\_60-rbf02-G0\_1C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_02-new.txt 48\_60-rbf02-G1C100.model 48\_60-rbf02-G1C100.output &> 48\_60-rbf02-G1C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_02-new.txt 48\_60-rbf02-G10C100.model 48\_60-rbf02-G10C100.output &> 48\_60-rbf02-G10C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_02-new.txt 48\_60-rbf02-G100C100.model 48\_60-rbf02-G100C100.output &> 48\_60-rbf02-G100C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_03-new.txt 48\_60-poly03-D1C0\_1.model 48\_60-poly03-D1C0\_1.output &> 48\_60-poly03-D1C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_03-new.txt 48\_60-poly03-D2C0\_1.model 48\_60-poly03-D2C0\_1.output &> 48\_60-poly03-D2C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_03-new.txt 48\_60-poly03-D3C0\_1.model 48\_60-poly03-D3C0\_1.output &> 48\_60-poly03-D3C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_03-new.txt 48\_60-poly03-D1C1.model 48\_60-poly03-D1C1.output &> 48\_60-poly03-D1C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_03-new.txt 48\_60-poly03-D2C1.model 48\_60-poly03-D2C1.output &> 48\_60-poly03-D2C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_03-new.txt 48\_60-poly03-D3C1.model 48\_60-poly03-D3C1.output &> 48\_60-poly03-D3C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_03-new.txt 48\_60-poly03-D1C10.model 48\_60-poly03-D1C10.output &> 48\_60-poly03-D1C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_03-new.txt 48\_60-poly03-D2C10.model 48\_60-poly03-D2C10.output &> 48\_60-poly03-D2C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_03-new.txt 48\_60-poly03-D3C10.model 48\_60-poly03-D3C10.output &> 48\_60-poly03-D3C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_03-new.txt 48\_60-poly03-D1C100.model 48\_60-poly03-D1C100.output &> 48\_60-poly03-D1C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_03-new.txt 48\_60-poly03-D2C100.model 48\_60-poly03-D2C100.output &> 48\_60-poly03-D2C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_03-new.txt 48\_60-poly03-D3C100.model 48\_60-poly03-D3C100.output &> 48\_60-poly03-D3C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_03-new.txt 48\_60-rbf03-G0\_1C0\_1.model 48\_60-rbf03-G0\_1C0\_1.output &> 48\_60-rbf03-G0\_1C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_03-new.txt 48\_60-rbf03-G1C0\_1.model 48\_60-rbf03-G1C0\_1.output &> 48\_60-rbf03-G1C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_03-new.txt 48\_60-rbf03-G10C0\_1.model 48\_60-rbf03-G10C0\_1.output &> 48\_60-rbf03-G10C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_03-new.txt 48\_60-rbf03-G100C0\_1.model 48\_60-rbf03-G100C0\_1.output &> 48\_60-rbf03-G100C0\_1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_03-new.txt 48\_60-rbf03-G0\_1C1.model 48\_60-rbf03-G0\_1C1.output &> 48\_60-rbf03-G0\_1C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_03-new.txt 48\_60-rbf03-G1C1.model 48\_60-rbf03-G1C1.output &> 48\_60-rbf03-G1C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_03-new.txt 48\_60-rbf03-G10C1.model 48\_60-rbf03-G10C1.output &> 48\_60-rbf03-G10C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_03-new.txt 48\_60-rbf03-G100C1.model 48\_60-rbf03-G100C1.output &> 48\_60-rbf03-G100C1.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_03-new.txt 48\_60-rbf03-G0\_1C10.model 48\_60-rbf03-G0\_1C10.output &> 48\_60-rbf03-G0\_1C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_03-new.txt 48\_60-rbf03-G1C10.model 48\_60-rbf03-G1C10.output &> 48\_60-rbf03-G1C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_03-new.txt 48\_60-rbf03-G10C10.model 48\_60-rbf03-G10C10.output &> 48\_60-rbf03-G10C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_03-new.txt 48\_60-rbf03-G100C10.model 48\_60-rbf03-G100C10.output &> 48\_60-rbf03-G100C10.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_03-new.txt 48\_60-rbf03-G0\_1C100.model 48\_60-rbf03-G0\_1C100.output &> 48\_60-rbf03-G0\_1C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_03-new.txt 48\_60-rbf03-G1C100.model 48\_60-rbf03-G1C100.output &> 48\_60-rbf03-G1C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_03-new.txt 48\_60-rbf03-G10C100.model 48\_60-rbf03-G10C100.output &> 48\_60-rbf03-G10C100.output

./libsvm-3.24/svm-predict New\_SVM\_Data/48\_60-tsPCA\_03-new.txt 48\_60-rbf03-G100C100.model 48\_60-rbf03-G100C100.output &> 48\_60-rbf03-G100C100.outputut

main.cpp

#include <iostream>

#include <math.h>

#include <vector>

#include <cmath>

#include <Eigen/Dense>

#include <algorithm>

#include "Bayes.cpp"

#include <cstdlib>

#include <string>

#include <fstream>

#include <sstream>

using namespace Eigen;

using namespace std;

/\*

USEFULL FUNCTIONS:

VectorXf ml\_mean(vector<VectorXf> x)

MatrixXf ml\_covariance(vector<VectorXf> x, VectorXf mean)

int classify\_case\_3(VectorXf x, VectorXf mu1, MatrixXf sigma1, VectorXf mu2, MatrixXf sigma2, float prior\_prob1, float prior\_prob2) \*\*\*returns 1 for class 1 and returns 2 for class 2\*\*\*

\*/

void readFaces(vector<VectorXf> &maleFaces, vector<VectorXf> &femaleFaces, string examplePath, string targetPath)

{

// clear vectors

maleFaces.clear();

femaleFaces.clear();

// open file streams

ifstream faceFile(examplePath);

ifstream targetFile(targetPath);

// get data from files

// store data in vectors

string line;

getline(targetFile, line);

istringstream targetStream(line);

while (getline(faceFile, line))

{

istringstream iss(line);

vector<float> values;

float val = 0;

while(true)

{

if (! (iss >> val) )

{

break;

}

values.push\_back(val);

}

VectorXf newFace(values.size());

for(unsigned int i = 0; i < values.size(); i++)

{

newFace.row(i) << values[i];

}

int bayesClass = 0;

if (! (targetStream >> bayesClass) )

{

cout << "Unable to read targets" << endl;

break;

}

if (bayesClass == 1)

{

maleFaces.push\_back(newFace);

}

else

{

femaleFaces.push\_back(newFace);

}

}

}

int main(){

//read in training faces

vector<VectorXf> maleTrainingFaces;

vector<VectorXf> femaleTrainingFaces;

readFaces(maleTrainingFaces, femaleTrainingFaces, "genderdata/48\_60/trPCA\_01.txt", "genderdata/48\_60/TtrPCA\_01.txt");

//calculate mean and covariance using ML

VectorXf maleMean = ml\_mean(maleTrainingFaces);

VectorXf femaleMean = ml\_mean(femaleTrainingFaces);

MatrixXf maleCovariance = ml\_covariance(maleTrainingFaces, maleMean);

MatrixXf femaleCovariance = ml\_covariance(femaleTrainingFaces, femaleMean);

//read in test faces

vector<VectorXf> maleTestFaces;

vector<VectorXf> femaleTestFaces;

readFaces(maleTestFaces, femaleTestFaces, "genderdata/48\_60/tsPCA\_01.txt", "genderdata/48\_60/TtsPCA\_01.txt");

//count the number of correct classifications

int count = 0;

//male test faces

for (int i = 0; i < maleTestFaces.size(); i++)

{

int classify = classify\_case\_3(maleTestFaces[i], maleMean, femaleMean, maleCovariance, femaleCovariance);

if (classify == 1)

{

count++;

}

}

//female test faces

for (int i = 0; i < femaleTestFaces.size(); i++)

{

int classify = classify\_case\_3(femaleTestFaces[i], maleMean, femaleMean, maleCovariance, femaleCovariance);

if (classify == 2)

{

count++;

}

}

return 0;

}

Bayes.cpp

/\*Implementation of case 3 of Bayesian Classifier\*/

float discriminant\_case\_3(VectorXf x, VectorXf mu, MatrixXf sigma, float prior\_prob)

{

float discriminant = (x.transpose() \* (-0.5 \* sigma.inverse()) \* x)

+ ((sigma.inverse() \* mu).transpose() \* x)(0) + (-0.5 \* mu.transpose() \* sigma.inverse() \* mu)

+ (-0.5 \* log(sigma.determinant()));

if(prior\_prob != 0.5)

{

discriminant += log(prior\_prob);

}

return discriminant;

}

/\*makes classification based on case 3\*/

int classify\_case\_3(VectorXf x, VectorXf mu1, MatrixXf sigma1, VectorXf mu2, MatrixXf sigma2, float prior\_prob1 = 0.5, float prior\_prob2 = 0.5)

{

float discriminant1 = discriminant\_case\_3(x, mu1, sigma1, prior\_prob1);

float discriminant2 = discriminant\_case\_3(x, mu2, sigma2, prior\_prob2);

if (discriminant1 > discriminant2)

{

return 1;

}

else

{

return 2;

}

}

/\*Gets ML mean\*/

VectorXf ml\_mean(vector<VectorXf> x)

{

VectorXf mean;

if(x.size() <= 0)

{

return mean;

}

mean = VectorXf::Zero(x[0].rows());

for(vector<int>::size\_type i = 0; i < x.size(); i++)

{

mean += x[i];

}

return mean / x.size();

}

/\*Gets ML covariance\*/

MatrixXf ml\_covariance(vector<VectorXf> x, VectorXf mean)

{

MatrixXf covariance;

if (x.size() <= 0)

{

return covariance;

}

covariance = MatrixXf::Zero(x[0].rows(), x[0].rows());

for (vector<int>::size\_type i = 0; i < x.size(); i++)

{

covariance += (mean - x[i])\*((mean - x[i]).transpose());

}

return covariance / x.size();

}