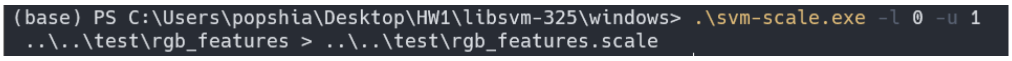
11077009 資訊碩一 林冠良 HW1 - libsvm

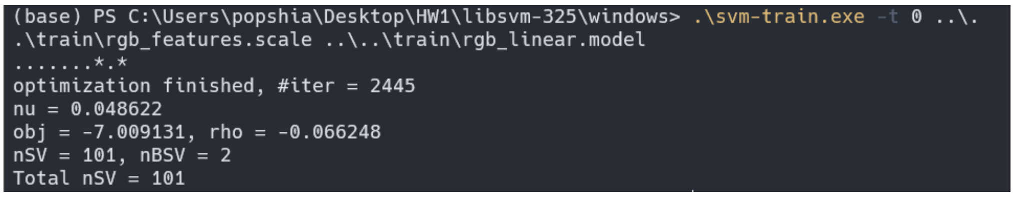
a. Using linear kernel and RGB color feature (400 × 3 dims for each image)

1. Use self-written txt_to_svm.py to convert the original feature values to svm file format.
2. Take the converted file and scale the data to be in [0, 1] using svm-scale.exe in libsvm-325/windows.



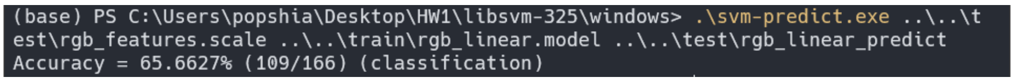
```
(base) PS C:\Users\popshia\Desktop\HW1\libsvm-325\windows> .\svm-scale.exe -l 0 -u 1
 ..\..\test\rgb_features > ..\..\test\rgb_features.scale
```

3. Use the scaled file as input and send it to svm-train.exe in the same directory.



```
(base) PS C:\Users\popshia\Desktop\HW1\libsvm-325\windows> .\svm-train.exe -t 0 ..\.
.\train\rgb_features.scale ..\..\train\rgb_linear.model
.......*.*
optimization finished, #iter = 2445
nu = 0.048622
obj = -7.009131, rho = -0.066248
nSV = 101, nBSV = 2
Total nSV = 101
```

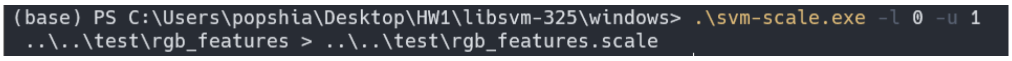
4. Predict the test dataset using the model file from previous step and get an accuracy of 65.6527%.



```
(base) PS C:\Users\popshia\Desktop\HW1\libsvm-325\windows> .\svm-predict.exe ..\..\t
est\rgb_features.scale ..\..\train\rgb_linear.model ..\..\test\rgb_linear_predict
Accuracy = 65.6627% (109/166) (classification)
```

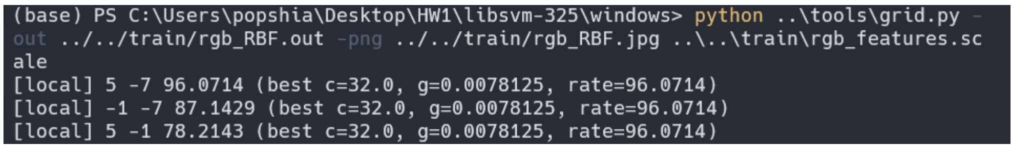
b. Using RBF kernel and RGB color feature

1. Use self-written txt_to_svm.py to convert the original feature values to svm file format.
2. Take the converted file and scale the data to be in [0, 1] using svm-scale.exe in libsvm-325/windows.

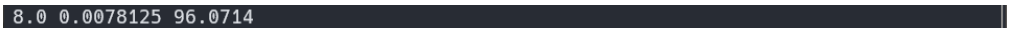


```
(base) PS C:\Users\popshia\Desktop\HW1\libsvm-325\windows> .\svm-scale.exe -l 0 -u 1
 ..\..\test\rgb_features > ..\..\test\rgb_features.scale
```

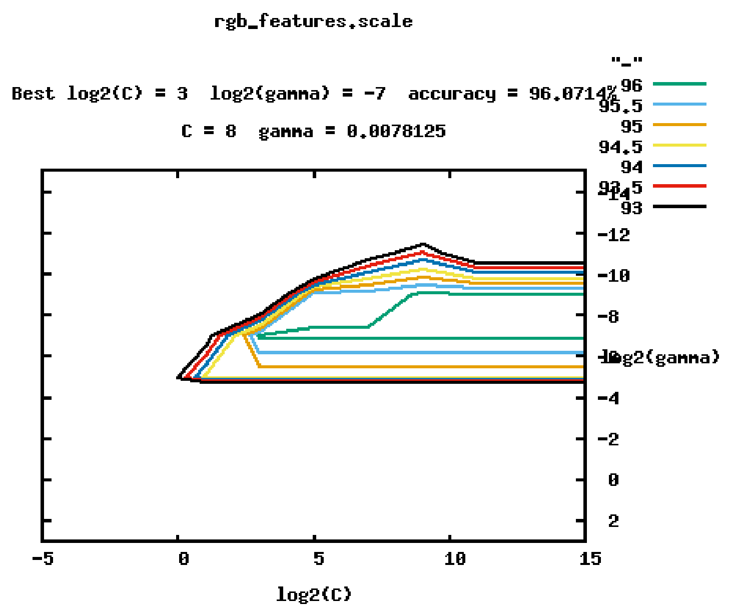
3. Use grip.py in the tools directory to find the best parameters.



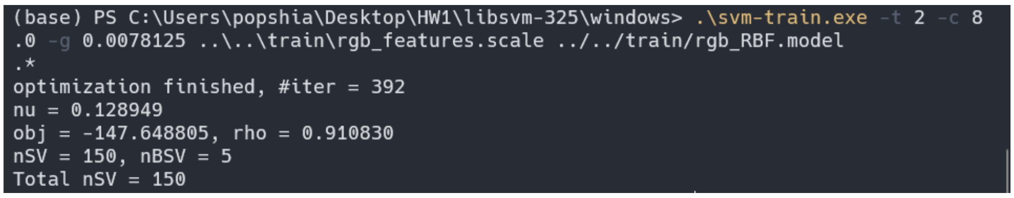
```
(base) PS C:\Users\popshia\Desktop\HW1\libsvm-325\windows> python ..\tools\grid.py -
out ../../train/rgb_RBF.out -png ../../train/rgb_RBF.jpg ..\..\train\rgb_features.sc
ale
[local] 5 -7 96.0714 (best c=32.0, g=0.0078125, rate=96.0714)
[local] -1 -7 87.1429 (best c=32.0, g=0.0078125, rate=96.0714)
[local] 5 -1 78.2143 (best c=32.0, g=0.0078125, rate=96.0714)
```



```
8.0 0.0078125 96.0714
```

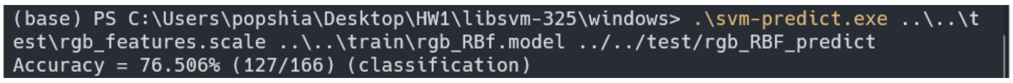


4. Take the best c and gamma from previous step and use it as parameters in the svm-train.exe command.



```
(base) PS C:\Users\popshia\Desktop\HW1\libsvm-325\windows> .\svm-train.exe -t 2 -c 8
.0 -g 0.0078125 ..\..\train\rgb_features.scale ../../train/rgb_RBF.model
.*
optimization finished, #iter = 392
nu = 0.128949
obj = -147.648805, rho = 0.910830
nSV = 150, nBSV = 5
Total nSV = 150
```

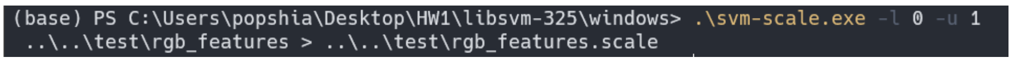
5. Predict the test dataset using the model file from previous step and get an accuracy of 76.506%



```
(base) PS C:\Users\popshia\Desktop\HW1\libsvm-325\windows> .\svm-predict.exe ..\..\t
est\rgb_features.scale ..\..\train\rgb_RBf.model ../../test/rgb_RBF_predict
Accuracy = 76.506% (127/166) (classification)
```

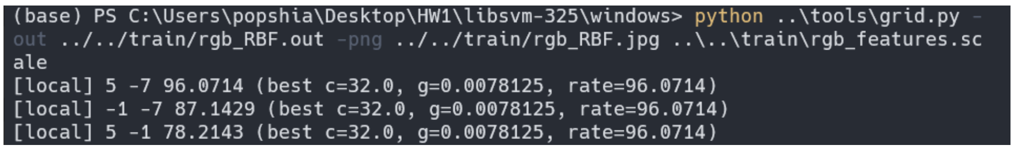
c. Using RBF kernel and RGB color feature, 5-fold cross validation

1. Use self-written txt_to_svm.py to convert the original feature values to svm file format.
2. Take the converted file and scale the data to be in [0, 1] using svm-scale.exe in libsvm-325/windows.

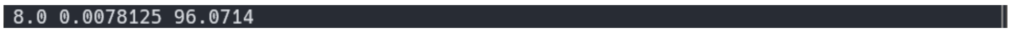


```
(base) PS C:\Users\popshia\Desktop\HW1\libsvm-325\windows> .\svm-scale.exe -l 0 -u 1
 ..\..\test\rgb_features > ..\..\test\rgb_features.scale
```

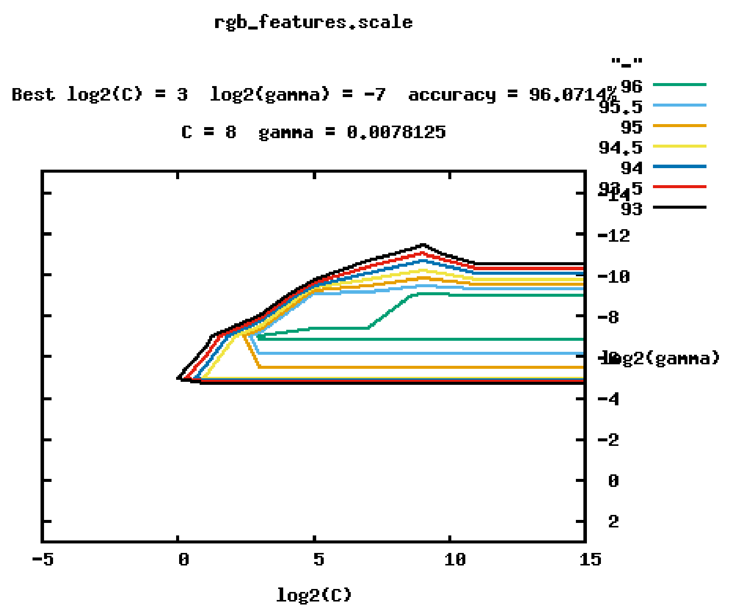
3. Use grip.py in the tools directory to find the best parameters.



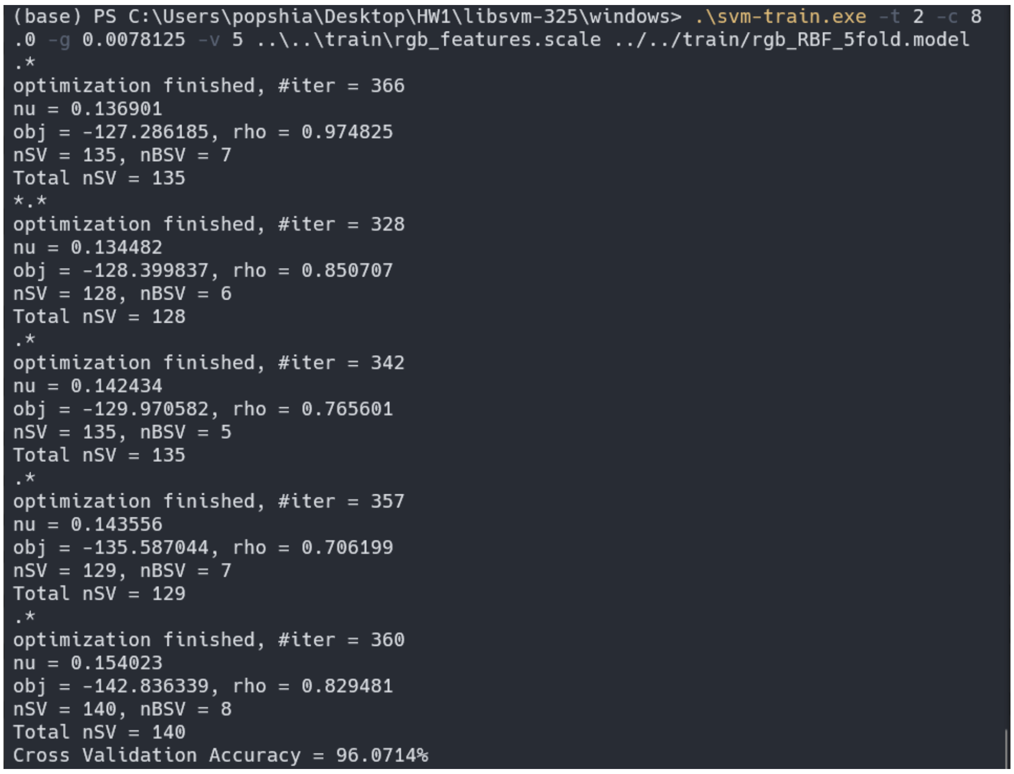
```
(base) PS C:\Users\popshia\Desktop\HW1\libsvm-325\windows> python ..\tools\grid.py -
out ../../train/rgb_RBF.out -png ../../train/rgb_RBF.jpg ..\..\train\rgb_features.sc
ale
[local] 5 -7 96.0714 (best c=32.0, g=0.0078125, rate=96.0714)
[local] -1 -7 87.1429 (best c=32.0, g=0.0078125, rate=96.0714)
[local] 5 -1 78.2143 (best c=32.0, g=0.0078125, rate=96.0714)
```



```
8.0 0.0078125 96.0714
```



4. Take the best parameters from previous step and add an option of 5-fold cross validation in the training step, in this situation, svm-train doesn't output a model, only a generalization performance.



```
(base) PS C:\Users\popshia\Desktop\HW1\libsvm-325\windows> .\svm-train.exe -t 2 -c 8
.0 -g 0.0078125 -v 5 ..\..\train\rgb_features.scale ../../train/rgb_RBF_5fold.model
.*
optimization finished, #iter = 366
nu = 0.136901
obj = -127.286185, rho = 0.974825
nSV = 135, nBSV = 7
Total nSV = 135
*.*
optimization finished, #iter = 328
nu = 0.134482
obj = -128.399837, rho = 0.850707
nSV = 128, nBSV = 6
Total nSV = 128
.*
optimization finished, #iter = 342
nu = 0.142434
obj = -129.970582, rho = 0.765601
nSV = 135, nBSV = 5
Total nSV = 135
.*
optimization finished, #iter = 357
nu = 0.143556
obj = -135.587044, rho = 0.706199
nSV = 129, nBSV = 7
Total nSV = 129
.*
optimization finished, #iter = 360
nu = 0.154023
obj = -142.836339, rho = 0.829481
nSV = 140, nBSV = 8
Total nSV = 140
Cross Validation Accuracy = 96.0714%
```

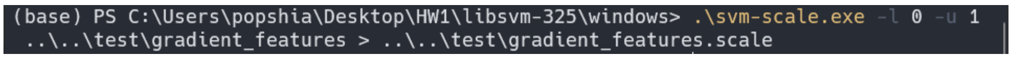
5. We can see that in the estimate generalization performance, the cross-validation accuracy is estimated to be 96.0714%.

d. Using linear kernel and gradient feature (4002 dims for each image)

1. Use self-written txt_to_svm.py to convert the original feature values to svm

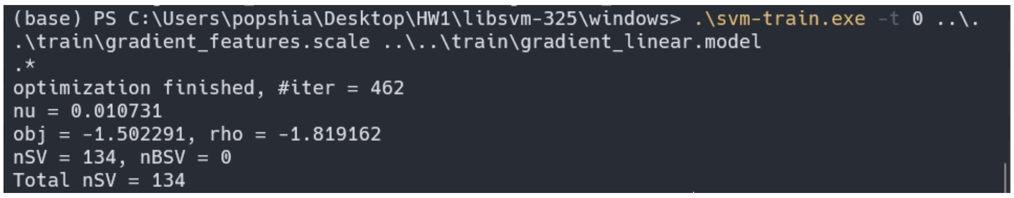
file format.

2. Take the converted file and scale the data to be in [0, 1] using svm-scale.exe in libsvm-325/windows.



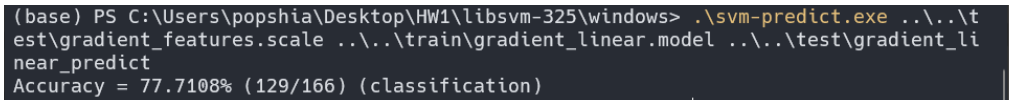
```
(base) PS C:\Users\popshia\Desktop\HW1\libsvm-325\windows> .\svm-scale.exe -l 0 -u 1
 ..\..\test\gradient_features > ..\..\test\gradient_features.scale
```

3. Use the scaled file as input and send it to svm-train.exe in the same directory.



```
(base) PS C:\Users\popshia\Desktop\HW1\libsvm-325\windows> .\svm-train.exe -t 0 ..\.
.\train\gradient_features.scale ..\..\train\gradient_linear.model
.*
optimization finished, #iter = 462
nu = 0.010731
obj = -1.502291, rho = -1.819162
nSV = 134, nBSV = 0
Total nSV = 134
```

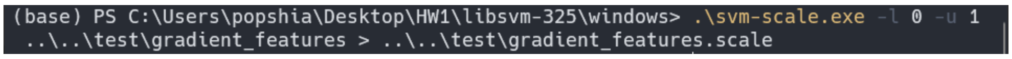
4. Predict the test dataset using the model file from previous step and get an accuracy of 77.7108%.



```
(base) PS C:\Users\popshia\Desktop\HW1\libsvm-325\windows> .\svm-predict.exe ..\..\t
est\gradient_features.scale ..\..\train\gradient_linear.model ..\..\test\gradient_li
near_predict
Accuracy = 77.7108% (129/166) (classification)
```

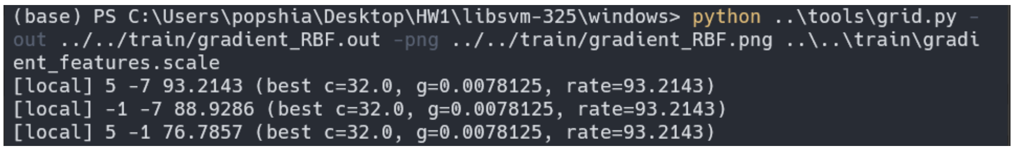
e. Using RBF kernel and gradient feature

1. Use self-written txt_to_svm.py to convert the original feature values to svm file format.
2. Take the converted file and scale the data to be in [0, 1] using svm-scale.exe in libsvm-325/windows.

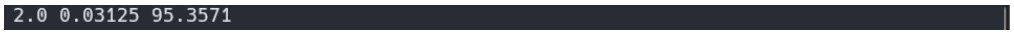


```
(base) PS C:\Users\popshia\Desktop\HW1\libsvm-325\windows> .\svm-scale.exe -l 0 -u 1
 ..\..\test\gradient_features > ..\..\test\gradient_features.scale
```

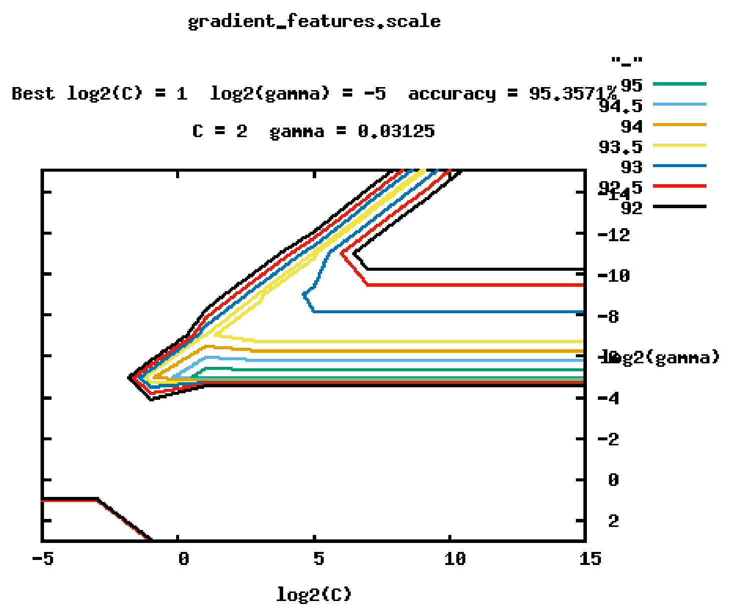
3. Use grip.py in the tools directory to find the best parameters.



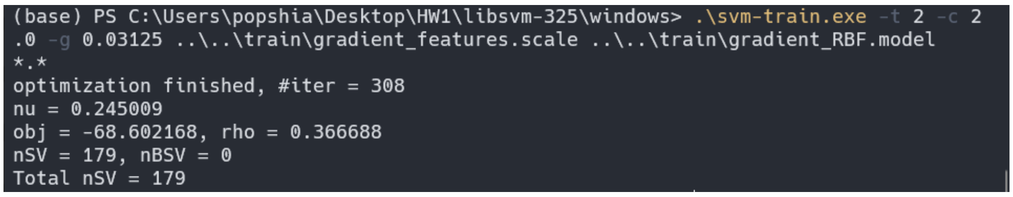
```
(base) PS C:\Users\popshia\Desktop\HW1\libsvm-325\windows> python ..\tools\grid.py -
out ../../train/gradient_RBF.out -png ../../train/gradient_RBF.png ..\..\train\gradi
ent_features.scale
[local] 5 -7 93.2143 (best c=32.0, g=0.0078125, rate=93.2143)
[local] -1 -7 88.9286 (best c=32.0, g=0.0078125, rate=93.2143)
[local] 5 -1 76.7857 (best c=32.0, g=0.0078125, rate=93.2143)
```



```
2.0 0.03125 95.3571
```

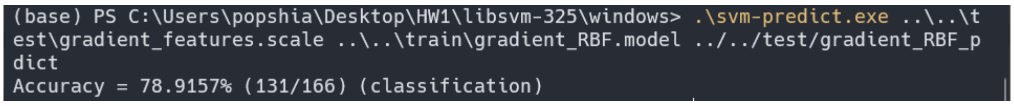


4. Take the best c and gamma from previous step and use it as parameters in the svm-train.exe command.



```
(base) PS C:\Users\popshia\Desktop\HW1\libsvm-325\windows> .\svm-train.exe -t 2 -c 2
.0 -g 0.03125 ..\..\train\gradient_features.scale ..\..\train\gradient_RBF.model
*.*
optimization finished, #iter = 308
nu = 0.245009
obj = -68.602168, rho = 0.366688
nSV = 179, nBSV = 0
Total nSV = 179
```

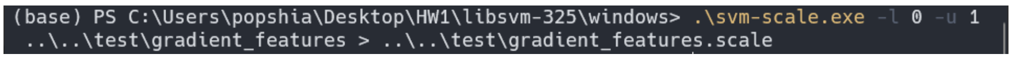
5. Predict the test dataset using the model file from previous step and get an accuracy of 78.9157%



```
(base) PS C:\Users\popshia\Desktop\HW1\libsvm-325\windows> .\svm-predict.exe ..\..\t
est\gradient_features.scale ..\..\train\gradient_RBF.model ../../test/gradient_RBF_p
dict
Accuracy = 78.9157% (131/166) (classification)
```

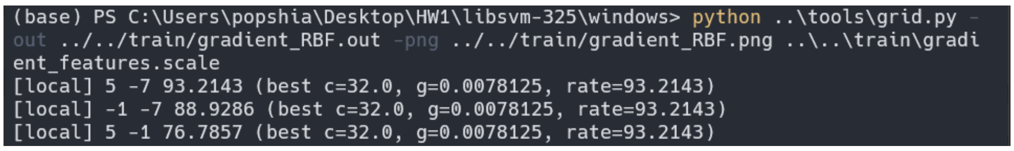
f. Using RBF kernel and gradient feature, 5-fold cross validation

1. Use self-written txt_to_svm.py to convert the original feature values to svm file format.
2. Take the converted file and scale the data to be in [0, 1] using svm-scale.exe in libsvm-325/windows.

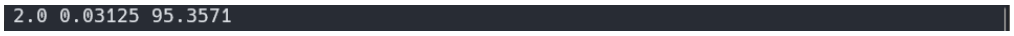


```
(base) PS C:\Users\popshia\Desktop\HW1\libsvm-325\windows> .\svm-scale.exe -l 0 -u 1
 ..\..\test\gradient_features > ..\..\test\gradient_features.scale
```

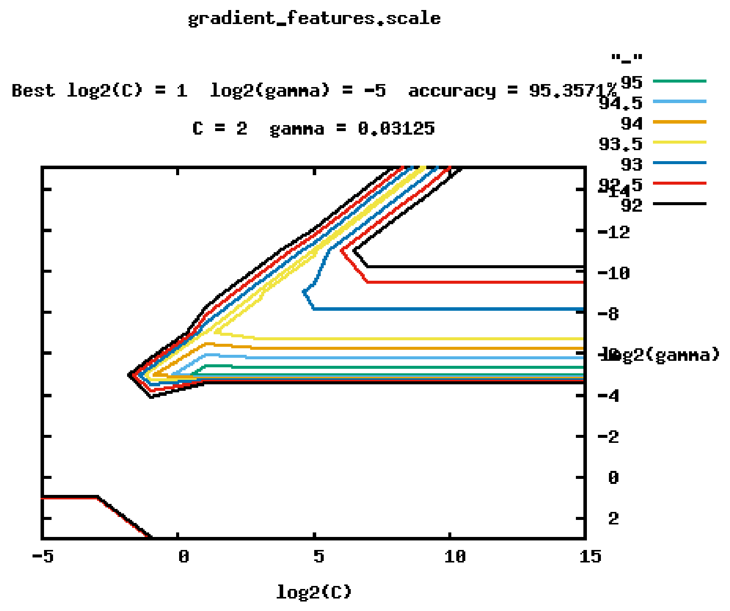
3. Use grip.py in the tools directory to find the best parameters.



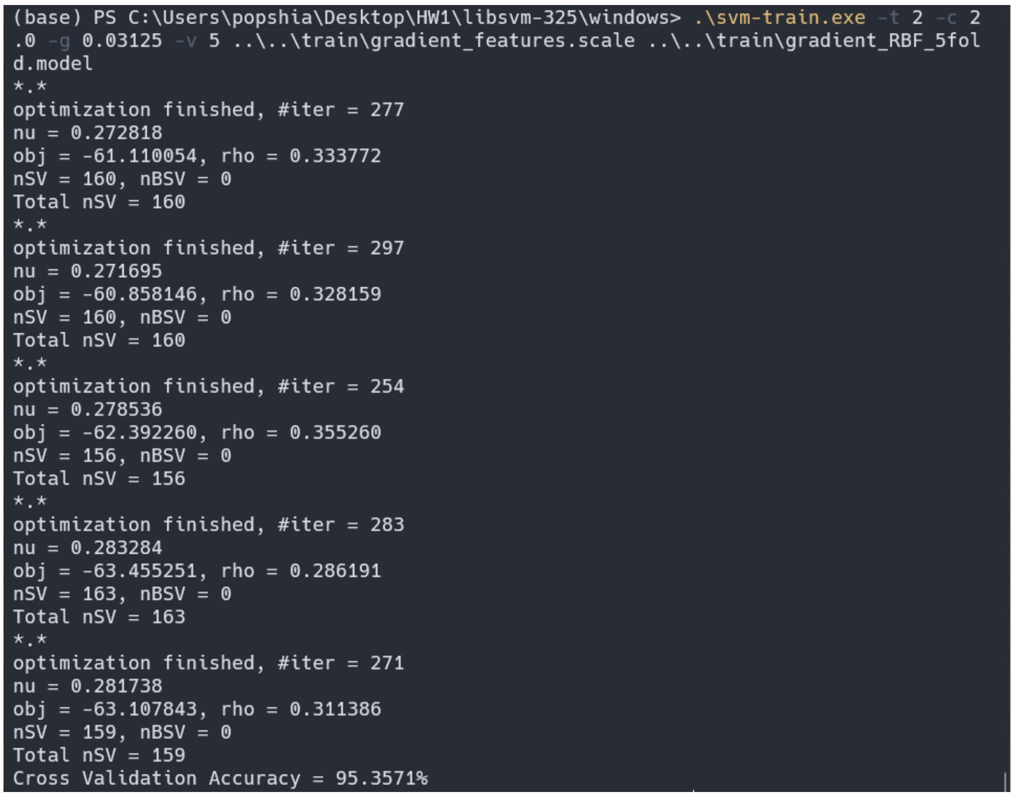
```
(base) PS C:\Users\popshia\Desktop\HW1\libsvm-325\windows> python ..\tools\grid.py -
out ../../train/gradient_RBF.out -png ../../train/gradient_RBF.png ..\..\train\gradi
ent_features.scale
[local] 5 -7 93.2143 (best c=32.0, g=0.0078125, rate=93.2143)
[local] -1 -7 88.9286 (best c=32.0, g=0.0078125, rate=93.2143)
[local] 5 -1 76.7857 (best c=32.0, g=0.0078125, rate=93.2143)
```



```
2.0 0.03125 95.3571
```



4. Take the best parameters from previous step and add an option of 5-fold cross validation in the training step, in this situation, svm-train doesn't output a model, only a generalization performance.



```
(base) PS C:\Users\popshia\Desktop\HW1\libsvm-325\windows> .\svm-train.exe -t 2 -c 2
.0 -g 0.03125 -v 5 ..\..\train\gradient_features.scale ..\..\train\gradient_RBF_5fol
d.model
*.*
optimization finished, #iter = 277
nu = 0.272818
obj = -61.110054, rho = 0.333772
nSV = 160, nBSV = 0
Total nSV = 160
*.*
optimization finished, #iter = 297
nu = 0.271695
obj = -60.858146, rho = 0.328159
nSV = 160, nBSV = 0
Total nSV = 160
*.*
optimization finished, #iter = 254
nu = 0.278536
obj = -62.392260, rho = 0.355260
nSV = 156, nBSV = 0
Total nSV = 156
*.*
optimization finished, #iter = 283
nu = 0.283284
obj = -63.455251, rho = 0.286191
nSV = 163, nBSV = 0
Total nSV = 163
*.*
optimization finished, #iter = 271
nu = 0.281738
obj = -63.107843, rho = 0.311386
nSV = 159, nBSV = 0
Total nSV = 159
Cross Validation Accuracy = 95.3571%
```

5. We can see that in the estimate generalization performance, the cross-validation accuracy is estimated to be 95.3571%.