



HOME CONTACT

ROC ANALYSIS

ABOUT

LINKS

DOWNLOAD

TUTORIAL

Statistical Analysis of ROC Curves

StAR is a server that computes ROC curves and several related statistics to assess the significance of their differences in performance.

StAR can receive as input several classifiers, compute their corresponding ROC curves and display the results graphically. The area under the curve (AUC) and other values obtained at the optimal threshold are also displayed.

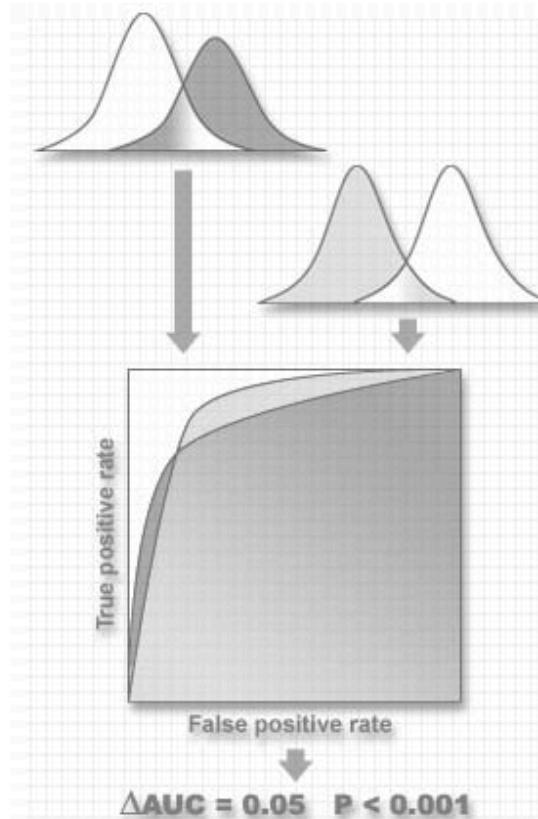
The core of the server relies on a non-parametric test for the difference of the AUC that accounts for the correlation of the ROC curves. This test takes advantage of the equality between the Mann-Whitney U-statistic for comparing distributions and the AUC when computed by the trapezoidal rule.

For more details about the statistical method implemented here, please read the following manuscript:

Vergara, I.A., Norambuena, T., Ferrada, E., Slater, A.W. and Melo, F. (2007) *StAR: a web tool for the statistical analyses of ROC curves*. *BMC Bioinformatics* (submitted).

If you use this server in your work and find it useful, please acknowledge it just by citing the reference above.

ROC ANALYSIS



Pontificia Universidad Católica de Chile | Molecular Bioinformatics Laboratory
©2007 StAR. All rights reserved.

StAR web server tutorial for ROC Analysis



HOME CONTACT

ROC ANALYSIS

ABOUT

LINKS

DOWNLOAD

TUTORIAL

Statistical Analysis of ROC Curves

StAR is a server that computes ROC curves and several related statistics to assess the significance of their differences in performance.

StAR can receive as input several classifiers, compute their corresponding ROC curves and display the results graphically. The area under the curve (AUC) and other values obtained at the optimal threshold are also displayed.

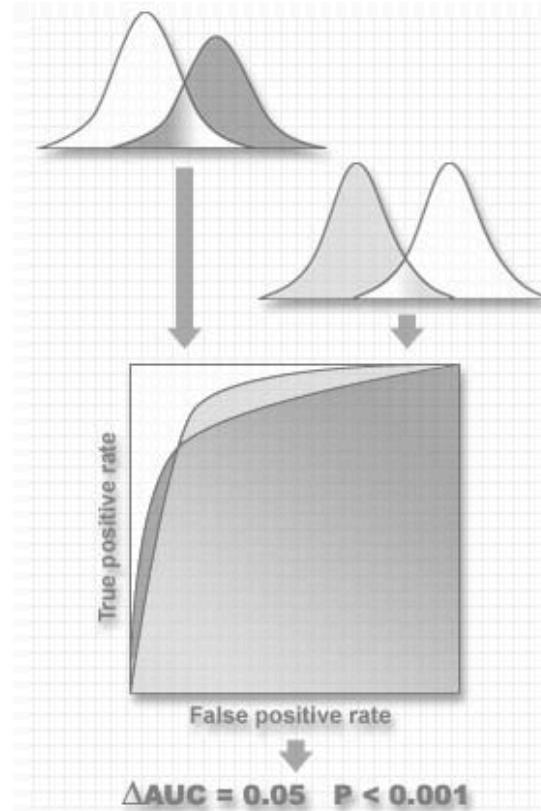
The core of the server relies on a non-parametric test for the difference of the AUC that accounts for the correlation of the ROC curves. This test takes advantage of the equality between the Mann-Whitney U-statistic for comparing distributions and the AUC when computed by the trapezoidal rule.

For more details about the statistical method implemented here, please read the following manuscript:

Vergara, I.A., Norambuena, T., Ferrada, E., Slater, A.W. and Melo, F. (2007) *StAR: a web tool for the statistical analyses of ROC curves*. *BMC Bioinformatics* (submitted).

If you use this server in your work and find it useful, please acknowledge it just by citing the reference above.

ROC ANALYSIS



Pontificia Universidad Católica de Chile | Molecular Bioinformatics Laboratory
©2007 StAR. All rights reserved.

ROC Analysis: This module allows the user to input data for several classifiers to be tested. The user can start by clicking any of the two ROC Analysis buttons highlighted with a red box.



HOME CONTACT

ROC ANALYSIS

ABOUT

LINKS

DOWNLOAD

TUTORIAL

Job Name

ROC Analysis Form

Job name (optional) [?](#)

Input Data [?](#)

Positive Class Data

File upload

Examinar...

Negative Class Data

or Paste data

Examinar...

Input Data

Options

Options [?](#)

Plot an inverted ROC curve when its AUC value is less than 0.5.

Show additional parameters at Optimal Threshold (Accuracy, fp and tp).

Sort results by descending AUC value.

Pontificia Universidad Católica de Chile | Molecular Bioinformatics Laboratory
©2007 StAR. All rights reserved.

ROC Analysis Form. This is the form you must complete in order to proceed with the analysis. There are three main sections: Job Name, Input Data and Options.



HOME CONTACT

ROC ANALYSIS

ABOUT

LINKS

DOWNLOAD

TUTORIAL

ROC Analysis Form

Job name (optional) [?](#)

Input Data [?](#)

File upload

 Examinar...

or Paste data

Negative Class Data

 Examinar...

Options [?](#)

Plot an inverted ROC curve when its AUC value is less than 0.5.

Show additional parameters at Optimal Threshold (Accuracy, fp and tp).

Sort results by descending AUC value.

ROC Analysis Form. Each section has online help with relevant details provided.



HOME CONTACT

ROC ANALYSIS

ABOUT

LINKS

DOWNLOAD

TUTORIAL

ROC Analysis Form

Job name (optional) [?](#)

Test Job

Input Data [?](#)

Positive Class Data

File upload

Examinar...

Negative Class Data

Examinar...

or Paste data

Options [?](#)

Plot an inverted ROC curve when its AUC value is less than 0.5.

Show additional parameters at Optimal Threshold (Accuracy, fp and tp).

Sort results by descending AUC value.

Pontificia Universidad Católica de Chile | Molecular Bioinformatics Laboratory
©2007 StAR. All rights reserved.

Job Name. The user can set a title for the job. This field is optional. In this case “Test Job” was chosen as job name.



HOME CONTACT

ROC ANALYSIS

ABOUT

LINKS

DOWNLOAD

TUTORIAL

ROC Analysis Form

Job name (optional) [?](#)

Test Job

Input Data [?](#)

Positive Class Data

[File upload](#)

Examinar...

[or Paste data](#)

Negative Class Data

Examinar...

Options [?](#)

Plot an inverted ROC curve when its AUC value is less than 0.5.

Show additional parameters at Optimal Threshold (Accuracy, fp and tp).

Sort results by descending AUC value.

[Submit Query](#)

[Reset](#)

Pontificia Universidad Católica de Chile | Molecular Bioinformatics Laboratory
©2007 StAR. All rights reserved.

Input Data. The user can upload data from his computer or paste it directly in the text area. The input data format is described in the help link.



HOME CONTACT

ROC ANALYSIS

ABOUT

LINKS

DOWNLOAD

TUTORIAL

ROC Analysis Form

Job name (optional) [?](#)

Test Job

Input Data [?](#)

Positive Class Data

File upload

Examinar...

Negative Class Data

Examinar...

or Paste data

Options [?](#)

Plot an inverte

Show addition

Sort results by

Demo data

Here you will find two files containing data to test this server.

[positives.dat](#)
[negatives.dat](#)

Large Sets

[positives.dat](#)
[negatives.dat](#)

Pontificia Universidad Católica de Chile | Molecular Bioinformatics Laboratory

Pontificia Universidad Católica de Chile | Molecular Bioinformatics Laboratory

©2007 StAR. All rights reserved.

Uploading files. As an example we will use a small data set, containing 200 observations each file. Those can be downloaded from our server by clicking on the Download button. Also a larger data set is provided for you to test the server in the same section.



HOME CONTACT

ROC ANALYSIS

ABOUT

LINKS

DOWNLOAD

TUTORIAL

ROC Analysis Form

Job name (optional) [?](#)

Test Job

Input Data [?](#)

Positive Class Data

File upload

positives.dat

[Examinar...](#)

Negative Class Data

negatives.dat

[Examinar...](#)

or Paste data

Options [?](#)

Plot an inverted ROC curve when its AUC value is less than 0.5.

Show additional parameters at Optimal Threshold (Accuracy, fp and tp).

Sort results by descending AUC value.

[Submit Query](#)

[Reset](#)

Uploading files. Click over the Browse button to select the file that will be uploaded. Try using the sample data sets available in our server (follow the download link). The user must be careful about the correct definition of the positive and negative data since the interpretation of results will depend on it.



ROC Analysis Form

Job name (optional) [?](#)

Test Job

Input Data [?](#)

Positive Class Data

File upload

[Examinar...](#)

or Paste data

```
"Csf-1" "Csf-2" "Csf-3" "Csf-4"  
"Csf-5"  
-2.30944 -0.6718 -13.5361  
-1.03216 -13.5361  
-1.93924 -1.0121  
-11.74764 -2.57446  
-10.38618  
0.10988 0.099 -14.60635  
0.49928 -10.79393  
-2.0761 -0.0427 -6.09452  
-1.14611 -6.09452
```

Negative Class Data

[Examinar...](#)

```
"Csf-1" "Csf-2" "Csf-3" "Csf-4"  
"Csf-5"  
-13.5361 -5.5265 -2.30944  
-1.40235 -2.30944  
-10.38618 -7.1325 -2.43624  
1.18462 -1.93924  
-10.79393 -7.1651 0.10988  
1.56341 0.10988  
-6.09452 -3.8177 -2.0761  
0.0229 -2.0761  
-1.6719 -2.7851 -2.72266
```

Options [?](#) Plot an inverted ROC curve when its AUC value is less than 0.5. Show additional parameters at Optimal Threshold (Accuracy, fp and tp). Sort results by descending AUC value.[Submit Query](#)[Reset](#)

Paste data. Positive and negative class data can be pasted on their respective text areas. Each file should contain multicolored data. Each column must be separated by tabs or blanks. The same column order should be present in both files. The data format is explained in detail by following the input data help link.



ROC Analysis Form

Job name (optional) [?](#)

Test Job

Input Data [?](#)

Positive Class Data

File upload

[Examinar...](#)

or Paste data

```
"CsF-1" "CsF-2" "CsF-3"  
"CsF-5"  
-2.30944 -0.6718  
-1.03216 -13.530  
-1.93924 -1.0121  
-11.74764 -2.5749  
-10.38618  
0.10988 0.099 -14.600  
0.49928 -10.79393  
-2.0761 -0.0427 -6.0948  
-1.14511 -6.0948
```

Negative Class Data

```
"CsF-1" "CsF-2" "CsF-3" "CsF-4"  
"CsF-5"  
-13.5361 -5.5265 -2.30944  
-1.40235 -2.30944  
-10.38618 -7.1325 -2.43624  
1.18462 -1.93924  
-10.79393 -7.1651 0.10988  
1.56341 0.10988  
-6.09452 -3.8177 -2.0761  
0.0229 -2.0761  
-1.6719 -2.7851 -2.72266
```

Options [?](#)

- Plot an inverted ROC curve
- Show additional parameters
- Sort results by descending P-value

13,646
-1,33013.646
-1.330

Value is less than 0.5.

Threshold (Accuracy, fp and tp).

[Submit Query](#)[Reset](#)

Uploading/Pasting data. Commas as decimal separator are also allowed for uploading/pasting data. The server will convert them to decimal points before proceeding with ROC analysis.

[HOME](#) [CONTACT](#)[ROC ANALYSIS](#)[ABOUT](#)[LINKS](#)[DOWNLOAD](#)[TUTORIAL](#)

ROC Analysis Form

Job name (optional) [?](#)

Input Data [?](#)

Positive Class Data

File upload

 Examinar...

or Paste data

```
"Csf-1" "Csf-2" "Csf-3" "Csf-4"  
"Csf-5"  
-2.30944 -0.6718 -13.5361  
-1.03216 -13.5361  
-1.93924 -1.0121  
-11.74764 -2.57446  
-10.38618  
0.10988 0.099 -14.60635  
0.49928 -10.79393  
-2.0761 -0.0427 -6.09452  
-1.14611 -6.09452
```

Negative Class Data

```
"Csf-1" "Csf-2" "Csf-3" "Csf-4"  
"Csf-5"  
-13.5361 -5.5265 -2.30944  
-1.40235 -2.30944  
-10.38618 -7.1325 -2.43624  
1.18462 -1.93924  
-10.79393 -7.1651 0.10988  
1.56341 0.10988  
-6.09452 -3.8177 -2.0761  
0.0229 -2.0761  
-4.6719 -2.7251 -2.72526
```

Options [?](#)

 Plot an inverted ROC curve when its AUC value is less than 0.5. Show additional parameters at Optimal Threshold (Accuracy, fp and tp). Sort results by descending AUC value.

Options. The user can choose to plot an **inverted ROC curve**, if AUC values are smaller than 0.5. This is intended for a better comparison amongst ROC plots. Also, you can choose to display the **Maximal Accuracy, false positive rate and true positive rate** at an **Optimal Threshold** estimated by the server (Optimal Threshold is defined as the classification threshold that leads to the maximal accuracy). Finally, results can be **sorted by descending AUC values** (For sorting AUC values, inverted ROC curves are always used). All these options are selected by default.



HOME CONTACT

ROC ANALYSIS

ABOUT

LINKS

DOWNLOAD

TUTORIAL

ROC Analysis Form

Job name (optional) [?](#)

Test Job

Input Data [?](#)

Positive Class Data

File upload

Examinar...

or Paste data

```
"Csf-1" "Csf-2" "Csf-3" "Csf-4"  
"Csf-5"  
-2.30944 -0.6718 -13.5361  
-1.03216 -13.5361  
-1.93924 -1.0121  
-11.74764 -2.57446  
-10.38618  
0.10988 0.099 -14.60635  
0.49928 -10.79393  
-2.0761 -0.0427 -6.09452  
-1.14611 -6.09452
```

Negative Class Data

Examinar...

```
"Csf-1" "Csf-2" "Csf-3" "Csf-4"  
"Csf-5"  
-13.5361 -5.5265 -2.30944  
-1.40235 -2.30944  
-10.38618 -7.1325 -2.43624  
1.18462 -1.93924  
-10.79393 -7.1651 0.10988  
1.56341 0.10988  
-6.09452 -3.8177 -2.0761  
0.0229 -2.0761  
-1.6719 -2.7851 -2.72266
```

Options [?](#)

Plot an inverted ROC curve when its AUC value is less than 0.5.

Show additional parameters at Optimal Threshold (Accuracy, fp and tp).

Sort results by descending AUC value.

Submit. The user is ready to submit the data to the server.

[HOME](#) [CONTACT](#)[ROC ANALYSIS](#)[ABOUT](#)[LINKS](#)[DOWNLOAD](#)[TUTORIAL](#)

Summary Statistics

n	View	Classifier	AUC	Inverted	ACC	OT	fp	tp	N	P
1	<input checked="" type="checkbox"/>	Csf-3	0.9917	+	0.9700	-4.0569	0.0350	0.3750	200	200
2	<input checked="" type="checkbox"/>	Csf-1	0.9764		0.9325	-4.0007	0.0350	0.9000	200	200
3	<input checked="" type="checkbox"/>	Csf-5	0.9735	+	0.9325	-4.0170	0.1100	0.9750	200	200
4	<input checked="" type="checkbox"/>	Csf-2	0.9542		0.8975	-2.6085	0.0700	0.8650	200	200
5	<input checked="" type="checkbox"/>	Csf-4	0.7301	+	0.6700	-1.6248	0.5000	0.8400	200	200

 Select all[PLOT/UPDATE
ROC CURVE\(S\)](#)[STATISTICAL
ANALYSIS I](#)[STATISTICAL
ANALYSIS II](#)[STATISTICAL
ANALYSIS III](#)[GENERATE
REPORT](#)[DOWNLOAD
RESULTS](#)

Output. Typical output of the StAR web server. Online help explaining the meaning of each column is obtained by left-clicking with the mouse over the column headers (surrounded by a red box). The user can select not to show those columns surrounded by a blue box.



HOME CONTACT

ROC ANALYSIS

ABOUT

LINKS

DOWNLOAD

TUTORIAL

Summary Statistics

n	View	Classifier	AUC	Inverted	ACC	OT	fp	tp	N	P
1	<input checked="" type="checkbox"/>	Csf-3	0.9917	+	0.9700	-4.0569	0.0350	0.9750	200	200
2	<input checked="" type="checkbox"/>	Csf-1	0.9764		0.9325	-4.0007	0.0350	0.9000	200	200
3	<input checked="" type="checkbox"/>	Csf-5	0.9735	+	0.9325	-4.0170	0.1100	0.9750	200	200
4	<input checked="" type="checkbox"/>	Csf-2	0.9542		0.8975	-2.6085	0.0700	0.8650	200	200
5	<input checked="" type="checkbox"/>	Csf-4	0.7301	+	0.6700	-1.6248	0.5000	0.8400	200	200

Select all

PLOT/UPDATE
ROC CURVE(S)

STATISTICAL
ANALYSIS I

STATISTICAL
ANALYSIS II

STATISTICAL
ANALYSIS III

GENERATE
REPORT

DOWNLOAD
RESULTS

Output. Typical output of the StAR web server. There are six actions the user can select to explore the results.

[HOME](#) [CONTACT](#)[ROC ANALYSIS](#)[ABOUT](#)[LINKS](#)[DOWNLOAD](#)[TUTORIAL](#)

Summary Statistics

n	View	Classifier	AUC	Inverted	ACC	OT	fp	tp	N	P
1	<input checked="" type="checkbox"/>	Csf-3	0.9917	+	0.9700	-4.0569	0.0350	0.9750	200	200
2	<input checked="" type="checkbox"/>	Csf-1	0.9764		0.9325	-4.0007	0.0350	0.9000	200	200
3	<input checked="" type="checkbox"/>	Csf-5	0.9735	+	0.9325	-4.0170	0.1100	0.9750	200	200
4	<input checked="" type="checkbox"/>	Csf-2	0.9542		0.8975	-2.6085	0.0700	0.8650	200	200
5	<input checked="" type="checkbox"/>	Csf-4	0.7301	+	0.6700	-1.6248	0.5000	0.8400	200	200

 Select all[PLOT/UPDATE
ROC CURVE\(S\)](#)[STATISTICAL
ANALYSIS I](#)[STATISTICAL
ANALYSIS II](#)[STATISTICAL
ANALYSIS III](#)[GENERATE
REPORT](#)[DOWNLOAD
RESULTS](#)

Output. The user can also select which classifiers are going to be plotted or analyzed. By default, all classifiers are selected.



Summary Statistics

n	View	Classifier	AUC	Inverted	ACC	OT	fp	tp	N	P
1	<input checked="" type="checkbox"/>	Csf-3	0.9917	+	0.9700	-4.0569	0.0350	0.9750	200	200
2	<input checked="" type="checkbox"/>	Csf-1	0.9764		0.9325	-4.0007	0.0350	0.9000	200	200
3	<input checked="" type="checkbox"/>	Csf-5	0.9735	+	0.9325	-4.0170	0.1100	0.9750	200	200
4	<input checked="" type="checkbox"/>	Csf-2	0.9542		0.8975	-2.6085	0.0700	0.8650	200	200
5	<input checked="" type="checkbox"/>	Csf-4	0.7301	+	0.6700	-1.6248	0.5000	0.8400	200	200

 Select allPLOT/UPDATE
ROC CURVE(S)STATISTICAL
ANALYSIS ISTATISTICAL
ANALYSIS IISTATISTICAL
ANALYSIS IIIGENERATE
REPORTDOWNLOAD
RESULTS

Output. Those classifiers whose Area Under the Curve (AUC) are smaller than 0.5 have been reversed (that is $AUC' = 1 - AUC$). They are pointed out by a plus sign in the **Inverted** column.

[HOME](#) [CONTACT](#)

ROC ANALYSIS		ABOUT		LINKS		DOWNLOAD		TUTORIAL	
--------------	--	-------	--	-------	--	----------	--	----------	--

Summary Statistics

n	View	Classifier	AUC	Inverted	ACC	OT	fp	tp	N	P
1	<input checked="" type="checkbox"/>	Csf-3	0.9917	+	0.9700	-4.0569	0.0350	0.9750	200	200
2	<input checked="" type="checkbox"/>	Csf-1	0.9764		0.9325	-4.0007	0.0350	0.9000	200	200
3	<input checked="" type="checkbox"/>	Csf-5	0.9735	+	0.9325	-4.0170	0.1100	0.9750	200	200
4	<input checked="" type="checkbox"/>	Csf-2	0.9542		0.8975	-2.6085	0.0700	0.8650	200	200
5	<input checked="" type="checkbox"/>	Csf-4	0.7301	+	0.6700	-1.6248	0.5000	0.8400	200	200

Select all

**PLOT/UPDATE
ROC CURVE(S)**

STATISTICAL
ANALYSIS I

STATISTICAL
ANALYSIS II

STATISTICAL
ANALYSIS III

GENERATE
REPORT

DOWNLOAD
RESULTS

Pontificia Universidad Católica de Chile | Molecular Bioinformatics Laboratory
©2007 StAR. All rights reserved.

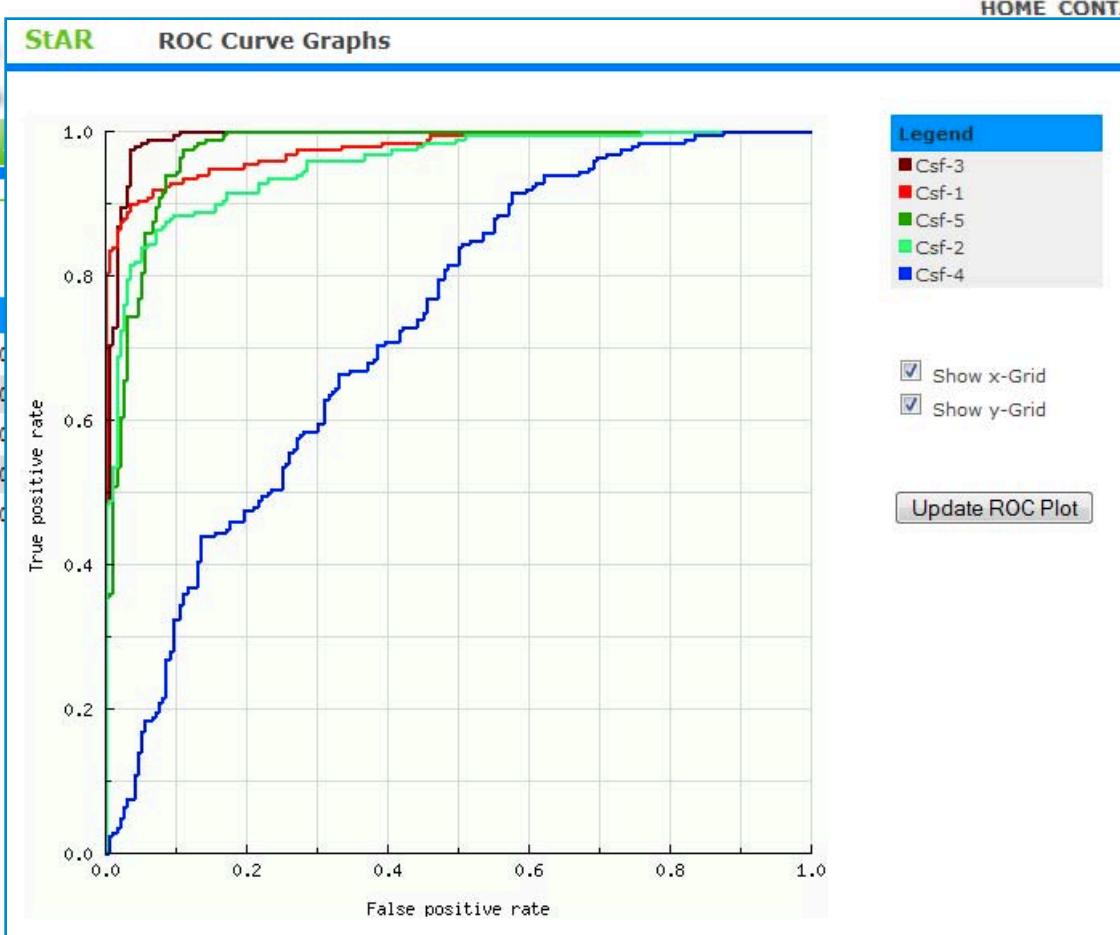
Plot/Update ROC curves. The user can plot the ROC curves for the selected classifiers by clicking on the highlighted button.



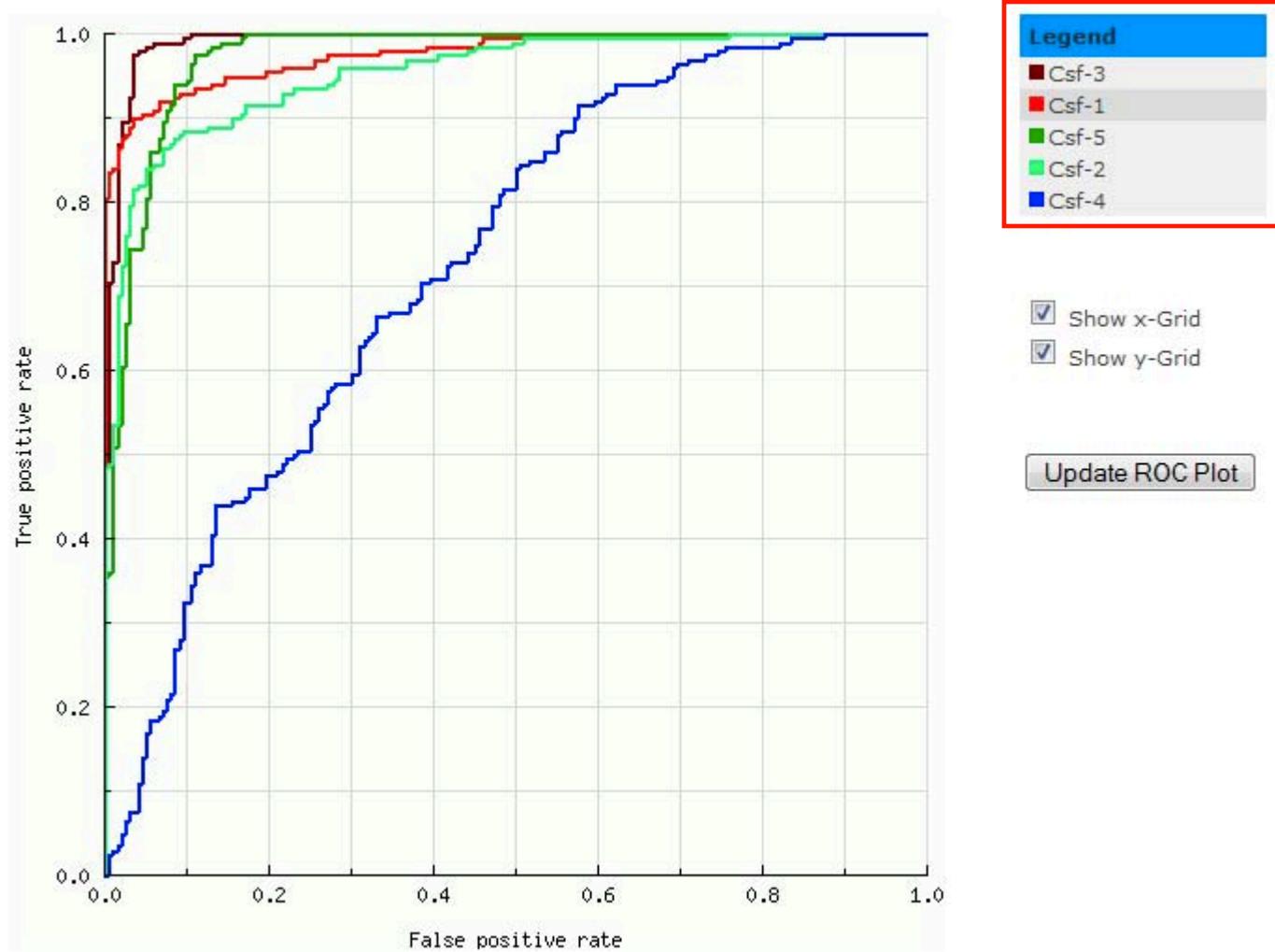
ROC ANALYSIS

Summary Statistics

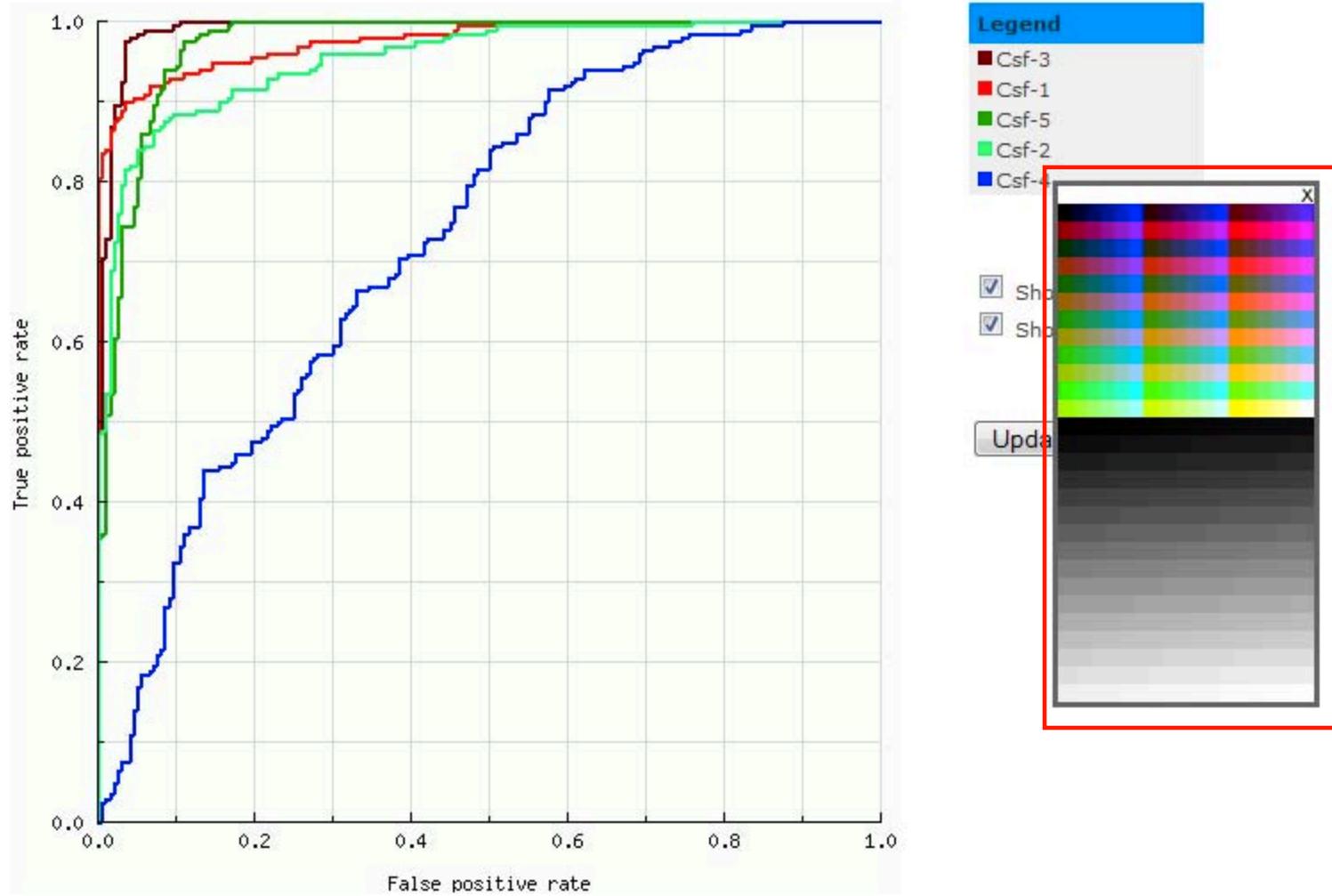
n	View	Classifier
1	<input checked="" type="checkbox"/>	Csf-3
2	<input checked="" type="checkbox"/>	Csf-1
3	<input checked="" type="checkbox"/>	Csf-5
4	<input checked="" type="checkbox"/>	Csf-2
5	<input checked="" type="checkbox"/>	Csf-4

 Select allPLOT/UPDATE
ROC CURVE(S)STATISTICAL
ANALYSIS ISTATISTICAL
ANALYSIS IISTATISTICAL
ANALYSIS IIIGENERATE
REPORTDOWNLOAD
RESULTS

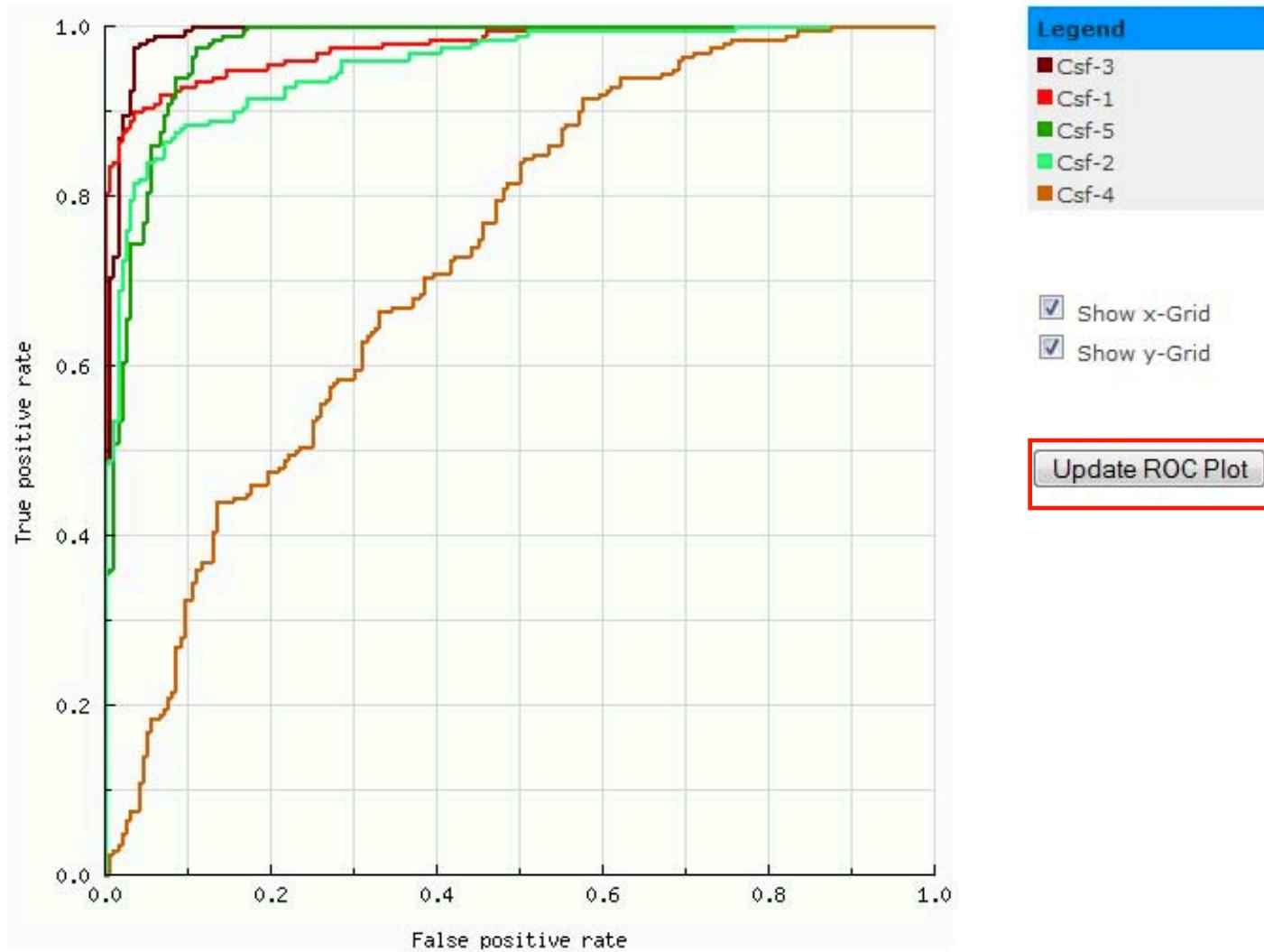
Plot/Update ROC curves. A new pop up window with the ROC plots will be displayed. The user can change several parameters to customize the plot.



Plot/Update ROC curves. Moving the mouse over the legend box will highlight the current classifier.



Changing the color of the ROC curves. Left-clicking over the current highlighted classifier will display a new window. The user can select the color by clicking any of the colored squares. Once the color is selected the window will be closed.



Changing the color of the ROC curves. The user must click the **Update ROC Plot** button to see the changes.



HOME CONTACT

ROC ANALYSIS

ABOUT

LINKS

DOWNLOAD

TUTORIAL

ROC Analysis Form

Job name (optional) [?](#)

Input Data [?](#)

Positive Class Data

File upload

[Examinar...](#)

Negative Class Data

[Examinar...](#)

or Paste data

Options [?](#)

Plot an inverted ROC curve when its AUC value is less than 0.5.

Show additional parameters at Optimal Threshold (Accuracy, fp and tp).

Sort results by descending AUC value.

[Submit Query](#)

[Reset](#)

Deactivating options. The user can optionally select not to invert AUC values that are lesser than 0.5.

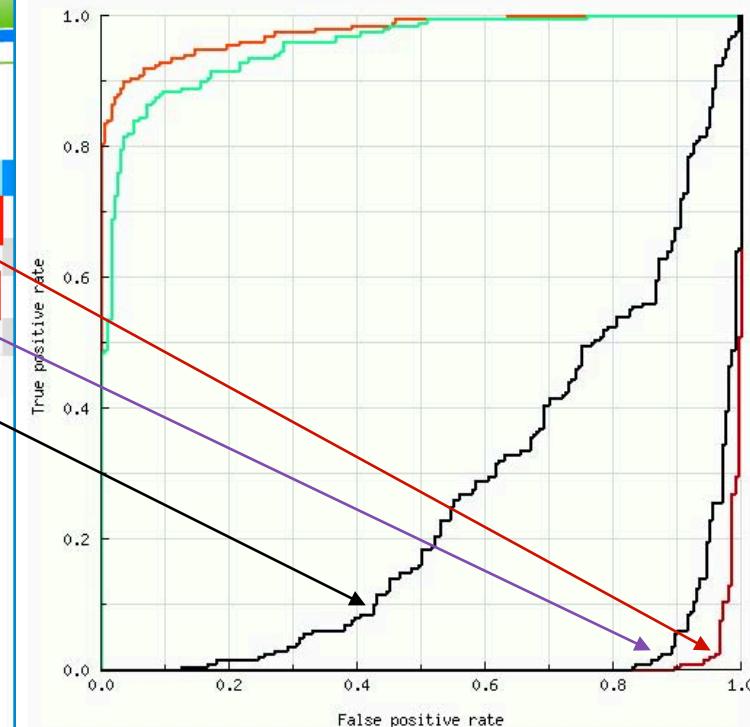
[HOME](#) [CONTACT](#)[ROC ANALYSIS](#)[ABOUT](#)

Summary Statistics

n	View	Classifier	AUC	Inverted
1	<input checked="" type="checkbox"/>	Csf-3	0.9917	+
2	<input checked="" type="checkbox"/>	Csf-1	0.9764	
3	<input checked="" type="checkbox"/>	Csf-5	0.9735	+
4	<input checked="" type="checkbox"/>	Csf-2	0.9542	
5	<input checked="" type="checkbox"/>	Csf-4	0.7301	+

 Select all

StAR ROC Curve Graphs



Legend
■ Csf-3
■ Csf-1
■ Csf-5
■ Csf-2
■ Csf-4

Show x-Grid
 Show y-Grid

[Update ROC Plot](#)

[PLOT/UPDATE ROC CURVE\(S\)](#)[STATISTICAL ANALYSIS I](#)[STATISTICAL ANALYSIS II](#)[STATISTICAL ANALYSIS III](#)[GENERATE REPORT](#)[DOWNLOAD RESULTS](#)

Deactivating options. True ROC curves are now plotted. Notice that AUC values are still inverted in the Summary Statistics section in order to perform the statistical analysis. This is intended to facilitate the comparison.



HOME CONTACT

ROC ANALYSIS

ABOUT

LINKS

DOWNLOAD

TUTORIAL

ROC Analysis Form

Job name (optional) [?](#)

Input Data [?](#)

Positive Class Data

File upload

[Examinar...](#)

Negative Class Data

[Examinar...](#)

or Paste data

Options [?](#)

Plot an inverted ROC curve when its AUC value is less than 0.5.

Show additional parameters at Optimal Threshold (Accuracy, fp and tp).

Sort results by descending AUC value.

[Submit Query](#)

[Reset](#)

Deactivating options. The user can optionally select not to show parameters at Optimal Threshold value.



HOME CONTACT

ROC ANALYSIS

ABOUT

LINKS

DOWNLOAD

TUTORIAL

Summary Statistics

n	View	Classifier	AUC	Inverted	N	P
1	<input checked="" type="checkbox"/>	Csf-3	0.9917	+	200	200
2	<input checked="" type="checkbox"/>	Csf-1	0.9764		200	200
3	<input checked="" type="checkbox"/>	Csf-5	0.9735	+	200	200
4	<input checked="" type="checkbox"/>	Csf-2	0.9542		200	200
5	<input checked="" type="checkbox"/>	Csf-4	0.7301	+	200	200

Select all

PLOT/UPDATE
ROC CURVE(S)

STATISTICAL
ANALYSIS I

STATISTICAL
ANALYSIS II

STATISTICAL
ANALYSIS III

GENERATE
REPORT

DOWNLOAD
RESULTS

Deactivating options. Accuracy, true positives and false positives values are not shown.

[HOME](#) [CONTACT](#)

ROC ANALYSIS		ABOUT		LINKS		DOWNLOAD		TUTORIAL																																																													
<h3>Summary Statistics</h3> <table border="1"><thead><tr><th>n</th><th>View</th><th>Classifier</th><th>AUC</th><th>Inv</th><th colspan="5"></th></tr></thead><tbody><tr><td>1</td><td><input checked="" type="checkbox"/></td><td>Csf-3</td><td>0.9917</td><td></td><td colspan="5"></td></tr><tr><td>2</td><td><input checked="" type="checkbox"/></td><td>Csf-1</td><td>0.9764</td><td></td><td colspan="5"></td></tr><tr><td>3</td><td><input checked="" type="checkbox"/></td><td>Csf-5</td><td>0.9735</td><td></td><td colspan="5"></td></tr><tr><td>4</td><td><input checked="" type="checkbox"/></td><td>Csf-2</td><td>0.9542</td><td></td><td colspan="5"></td></tr><tr><td>5</td><td><input checked="" type="checkbox"/></td><td>Csf-4</td><td>0.7301</td><td></td><td colspan="5"></td></tr></tbody></table> <p><input checked="" type="checkbox"/> Select all</p>										n	View	Classifier	AUC	Inv						1	<input checked="" type="checkbox"/>	Csf-3	0.9917							2	<input checked="" type="checkbox"/>	Csf-1	0.9764							3	<input checked="" type="checkbox"/>	Csf-5	0.9735							4	<input checked="" type="checkbox"/>	Csf-2	0.9542							5	<input checked="" type="checkbox"/>	Csf-4	0.7301						
n	View	Classifier	AUC	Inv																																																																	
1	<input checked="" type="checkbox"/>	Csf-3	0.9917																																																																		
2	<input checked="" type="checkbox"/>	Csf-1	0.9764																																																																		
3	<input checked="" type="checkbox"/>	Csf-5	0.9735																																																																		
4	<input checked="" type="checkbox"/>	Csf-2	0.9542																																																																		
5	<input checked="" type="checkbox"/>	Csf-4	0.7301																																																																		
<h3>StAR Statistical Analysis I: AUC Differences</h3> <p>Significance Level (alpha): 0.05 <input type="button" value="Update"/></p> <p>Upper Triangle: AUC Differences Lower Triangle: p-values p-value < 0.05 p-value ≥ 0.05</p> <table border="1"><thead><tr><th>Classifiers</th><th>Csf-3</th><th>Csf-1</th><th>Csf-5</th><th>Csf-2</th><th>Csf-4</th></tr></thead><tbody><tr><td>Csf-3</td><td>Csf-3</td><td>0.0152</td><td>0.0182</td><td>0.0375</td><td>0.2616</td></tr><tr><td>Csf-1</td><td>0.0379</td><td>Csf-1</td><td>0.0029</td><td>0.0223</td><td>0.2463</td></tr><tr><td>Csf-5</td><td>0.0025</td><td>0.7603</td><td>Csf-5</td><td>0.0193</td><td>0.2434</td></tr><tr><td>Csf-2</td><td>0.0002</td><td>0.0234</td><td>0.1024</td><td>Csf-2</td><td>0.2240</td></tr><tr><td>Csf-4</td><td>0.0000</td><td>0.0000</td><td>0.0000</td><td>0.0000</td><td>Csf-4</td></tr></tbody></table>										Classifiers	Csf-3	Csf-1	Csf-5	Csf-2	Csf-4	Csf-3	Csf-3	0.0152	0.0182	0.0375	0.2616	Csf-1	0.0379	Csf-1	0.0029	0.0223	0.2463	Csf-5	0.0025	0.7603	Csf-5	0.0193	0.2434	Csf-2	0.0002	0.0234	0.1024	Csf-2	0.2240	Csf-4	0.0000	0.0000	0.0000	0.0000	Csf-4																								
Classifiers	Csf-3	Csf-1	Csf-5	Csf-2	Csf-4																																																																
Csf-3	Csf-3	0.0152	0.0182	0.0375	0.2616																																																																
Csf-1	0.0379	Csf-1	0.0029	0.0223	0.2463																																																																
Csf-5	0.0025	0.7603	Csf-5	0.0193	0.2434																																																																
Csf-2	0.0002	0.0234	0.1024	Csf-2	0.2240																																																																
Csf-4	0.0000	0.0000	0.0000	0.0000	Csf-4																																																																
PLOT/UPDATE ROC CURVE(S)		STATISTICAL ANALYSIS I		STATISTICAL ANALYSIS II		STATISTICAL ANALYSIS III		GENERATE REPORT																																																													
								DOWNLOAD RESULTS																																																													

Statistical Analysis I. A new pop up window will be displayed with a table containing the p-values of each pairwise comparison of classifiers. Comparisons where the differences are statistically significant at the selected p-value are shown in green color; otherwise the value is shown in red color. Significance level is set at 0.05 by default. For former users of this server, as of 2010 the Global p-value was removed from StAR.



HOME CONTACT

ROC ANALYSIS

ABOUT

LINKS

DOWNLOAD

TUTORIAL

Summary Statistics

n	View	Classifier	AUC	Inverted
1	<input checked="" type="checkbox"/>	Csf-3	0.9917	+
2	<input checked="" type="checkbox"/>	Csf-1	0.9764	
3	<input checked="" type="checkbox"/>	Csf-5	0.9735	+
4	<input checked="" type="checkbox"/>	Csf-2	0.9542	
5	<input checked="" type="checkbox"/>	Csf-4	0.7301	+

Select all

StAR Statistical Analysis I: AUC Differences

Significance Level (alpha): 0.01

Upper Triangle: AUC Differences

Lower Triangle: p-values

p-value < 0.01

p-value ≥ 0.01

Classifiers	Csf-3	Csf-1	Csf-5	Csf-2	Csf-4
Csf-3	Csf-3	0.0152	0.0182	0.0375	0.2616
Csf-1	0.0379	Csf-1	0.0029	0.0223	0.2463
Csf-5	0.0025	0.7603	Csf-5	0.0193	0.2434
Csf-2	0.0002	0.0234	0.1024	Csf-2	0.2240
Csf-4	0.0000	0.0000	0.0000	0.0000	Csf-4

PLOT/UPDATE
ROC CURVE(S)

STATISTICAL
ANALYSIS II

STATISTICAL
ANALYSIS III

GENERATE
REPORT

DOWNLOAD
RESULTS

Statistical Analysis I. The user can modify the significance level value by typing a new one directly on the text field. The **Update** button must be pushed in order to make changes effective.

[HOME](#) [CONTACT](#)[ROC ANALYSIS](#)[ABOUT](#)[LINKS](#)[DOWNLOAD](#)[TUTORIAL](#)

Summary Statistics

n	View	Classifier	AUC
1	<input checked="" type="checkbox"/>	Csf-3	0.9917
2	<input checked="" type="checkbox"/>	Csf-1	0.9764
3	<input checked="" type="checkbox"/>	Csf-5	0.9735
4	<input checked="" type="checkbox"/>	Csf-2	0.9542
5	<input checked="" type="checkbox"/>	Csf-4	0.7301

 Select all

StAR Statistical Analysis II: Covariance Matrix

Classifiers	Csf-3	Csf-1	Csf-5	Csf-2	Csf-4
Csf-3	1.243e-5	-5.654e-7	1.370e-5	-8.980e-7	7.467e-6
Csf-1	-5.654e-7	4.041e-5	-1.012e-6	1.646e-5	1.974e-6
Csf-5	1.370e-5	-1.012e-6	5.106e-5	6.128e-8	3.064e-5
Csf-2	-8.980e-7	1.646e-5	6.128e-8	8.891e-5	-2.760e-6
Csf-4	7.467e-6	1.974e-6	3.064e-5	-2.760e-6	6.199e-4

[PLOT/UPDATE
ROC CURVE\(S\)](#)[STATISTICAL
ANALYSIS I](#)[STATISTICAL
ANALYSIS II](#)[STATISTICAL
ANALYSIS III](#)[GENERATE
REPORT](#)[DOWNLOAD
RESULTS](#)

Statistical Analysis II. A new pop up window will be displayed with a table containing the estimated covariance matrix.

[HOME](#) [CONTACT](#)[ROC ANALYSIS](#)[ABOUT](#)[LINKS](#)[DOWNLOAD](#)[TUTORIAL](#)**Summary Statistics**

n	View	Classifier
1	<input checked="" type="checkbox"/>	Csf-1
2	<input checked="" type="checkbox"/>	Csf-2
3	<input checked="" type="checkbox"/>	Csf-4
4	<input checked="" type="checkbox"/>	Csf-5
5	<input checked="" type="checkbox"/>	Csf-3

 Select all**StAR Statistical Analysis III: Confidence Intervals**

Classifier 1 / Classifier 2	AUC Difference	Confidence Interval
Csf-1/Csf-2	0.0223	(0.00302 , 0.04151)
Csf-1/Csf-3	-0.0152	(-0.02965 , -0.00085)
Csf-1/Csf-4	0.2463	(0.19609 , 0.29651)
Csf-1/Csf-5	0.0029	(-0.01600 , 0.02190)
Csf-2/Csf-3	-0.0375	(-0.05742 , -0.01761)
Csf-2/Csf-4	0.2240	(0.17166 , 0.27642)
Csf-2/Csf-5	-0.0193	(-0.04249 , 0.00387)
Csf-3/Csf-4	0.2616	(0.21285 , 0.31025)
Csf-3/Csf-5	0.0182	(0.00643 , 0.02998)
Csf-4/Csf-5	-0.2434	(-0.29174 , -0.19496)

N	P
200	200
200	200
200	200
200	200
200	200

[PLOT/UPDATE ROC CURVE\(S\)](#)[STATISTICAL ANALYSIS I](#)[STATISTICAL ANALYSIS II](#)[STATISTICAL ANALYSIS III](#)[GENERATE REPORT](#)[DOWNLOAD RESULTS](#)

Statistical Analysis III. A new pop up window displaying the confidence intervals for each pairwise comparison of classifiers at the selected significance level will be shown.

[HOME](#) [CONTACT](#)[ROC ANALYSIS](#)[ABOUT](#)[LINKS](#)[DOWNLOAD](#)[TUTORIAL](#)**Summary Statistics**

n	View	Classifier	AUC
1	<input checked="" type="checkbox"/>	Csf-3	0.9
2	<input checked="" type="checkbox"/>	Csf-1	0.9
3	<input checked="" type="checkbox"/>	Csf-5	0.9
4	<input checked="" type="checkbox"/>	Csf-2	0.9
5	<input checked="" type="checkbox"/>	Csf-4	0.9

 Select all**StAR Statistical Analysis III: Confidence Intervals**

Classifier 1 / Classifier 2	AUC Difference	Confidence Interval
Csf-1/Csf-2	0.0223	(0.00302 , 0.04151)
Csf-1/Csf-3	-0.0152	(-0.02965 , -0.00085)
Csf-1/Csf-4	0.2463	(0.19609 , 0.29651)
Csf-1/Csf-5	0.0029	(-0.01600 , 0.02190)
Csf-2/Csf-3	-0.0375	(-0.05742 , -0.01761)
Csf-2/Csf-4	0.2240	(0.17166 , 0.27642)
Csf-2/Csf-5	-0.0193	(-0.04249 , 0.00387)
Csf-3/Csf-4	0.2616	(0.21285 , 0.31025)
Csf-3/Csf-5	0.0182	(0.00643 , 0.02998)
Csf-4/Csf-5	-0.2434	(-0.29174 , -0.19496)

N	P
200	200
200	200
200	200
200	200
200	200

[PLOT/UPDATE ROC CURVE\(S\)](#)[STATISTICAL ANALYSIS I](#)[STATISTICAL ANALYSIS II](#)[STATISTICAL ANALYSIS III](#)[GENERATE REPORT](#)[DOWNLOAD RESULTS](#)

Statistical Analysis III. The modification of the significance level must be carried out in the section **Statistical Analysis II**, but it will be immediately effective for the calculation of confidence intervals of **Statistical Analysis III**.



HOME CONTACT

ROC ANALYSIS

ABOUT

LINKS

DOWNLOAD

TUTORIAL

Summary Statistics

n	View	Classifier	AUC	Inverted	ACC	OT	fp	tp	N	P
1	<input checked="" type="checkbox"/>	Csf-3	0				0.0350	0.9750	200	200
2	<input checked="" type="checkbox"/>	Csf-1	0				0.0350	0.9000	200	200
3	<input checked="" type="checkbox"/>	Csf-5	0				0.1100	0.9750	200	200
4	<input checked="" type="checkbox"/>	Csf-2	0				0.0700	0.8650	200	200
5	<input checked="" type="checkbox"/>	Csf-4	0				0.5000	0.8400	200	200

Select all

StAR Generate Report

DOWNLOAD REPORT

PLOT/UPDATE
ROC CURVE(S)

STATISTICAL
ANALYSIS I

STATISTICAL
ANALYSIS II

STATISTICAL
ANALYSIS III

GENERATE
REPORT

DOWNLOAD
RESULTS

Pontificia Universidad Católica de Chile | Molecular Bioinformatics Laboratory
©2007 StAR. All rights reserved.

Generate Report. The user can generate and download a simple report in PDF format (gzipped), which contains a summary of the results. This includes the ROC plots and summary statistics for the selected classifiers.

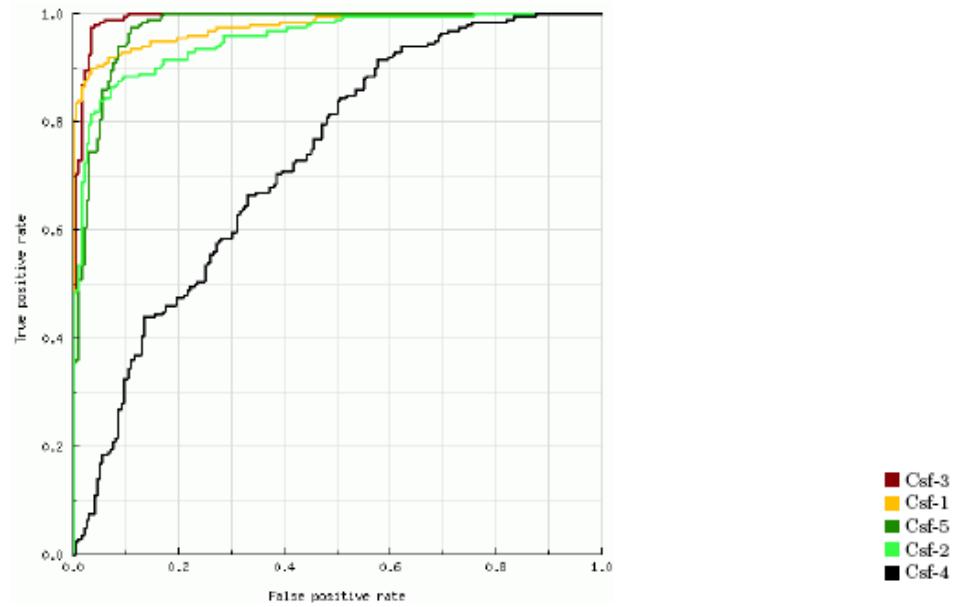
StAR Report for the Analysis of ROC Curves

Generated at <http://protein.bio.puc.cl/star.html>

January 15, 2008

PDF Report. An example of the PDF report generated with StAR.

1 ROC Plots



PDF Report. An example of the PDF report generated with StAR.

2 Summary Statistics

Classifier	AUC	Inverted	ACC	OT	fp	tp	N	P
Csf-3	0.9917	+	0.9700	-4.0569	0.0350	0.9750	200	200
Csf-1	0.9764	-	0.9325	-4.0007	0.0350	0.9000	200	200
Csf-5	0.9735	+	0.9325	-4.0170	0.1100	0.9750	200	200
Csf-2	0.9542	-	0.8975	-2.6085	0.0700	0.8650	200	200
Csf-4	0.7301	+	0.6700	-1.6248	0.5000	0.8400	200	200

AUC: area under the ROC curve. ACC: maximal accuracy. OT: optimal threshold.

fp: false positive rate at OT. tp: true positive rate at OT.

N: number of negative instances. P: number of positive instances.

3 Statistical Analysis I

	Csf-3	Csf-1	Csf-5	Csf-2	Csf-4
Csf-3	-	0.01525	0.01820	0.03751	0.26155
Csf-1	0.03792	-	0.00295	0.02226	0.24630
Csf-5	0.00245	0.76031	-	0.01931	0.24335
Csf-2	0.00022	0.02336	0.10245	-	0.22404
Csf-4	0.00000	0.00000	0.00000	0.00000	-

Significance Level (alpha): 0.05

Upper Triangle: AUC differences

Bottom Triangle: p-values

p-value <0.05

p-value >0.05

Global p-value: 1

PDF Report. An example of the PDF report generated with StAR.

[HOME](#) [CONTACT](#)[ROC ANALYSIS](#)[ABOUT](#)[LINKS](#)[DOWNLOAD](#)[TUTORIAL](#)

Summary Statistics

n	View	Classifier	AUC	Inverted	ACC	OT	fp	tp	N	P
1	<input checked="" type="checkbox"/>	Csf-3	0.9917	+	0.9700	-4.0569	0.0350	0.9750	200	200
2	<input checked="" type="checkbox"/>	Csf-1	0.9764		0.9325	-4.0007	0.0350	0.9000	200	200
3	<input checked="" type="checkbox"/>	Csf-5	0.9735	+	0.9325	-4.0170	0.1100	0.9750	200	200
4	<input checked="" type="checkbox"/>	Csf-2	0.9542		0.8975	-2.6085	0.0700	0.8650	200	200
5	<input checked="" type="checkbox"/>	Csf-4	0.7301	+	0.6700	-1.6248	0.5000	0.8400	200	200

 Select all[PLOT/UPDATE
ROC CURVE\(S\)](#)[STATISTICAL
ANALYSIS I](#)[STATISTICAL
ANALYSIS II](#)[STATISTICAL
ANALYSIS III](#)[GENERATE
REPORT](#)[DOWNLOAD
RESULTS](#)

Download Results. The user can download a zipped file that contains the results from the analysis of the StAR server. All these files are in plain-text format, and contains the raw data and results. These files can be easily imported into other software for further analysis and visualization.

Statistical Analysis of ROC Curves

StAR is a server that computes ROC curves and several related statistics to assess the significance of their differences in performance.

StAR can receive as input several classifiers, compute their corresponding ROC curves and display the results graphically. The area under the curve (AUC) and other values obtained at the optimal threshold are also displayed.

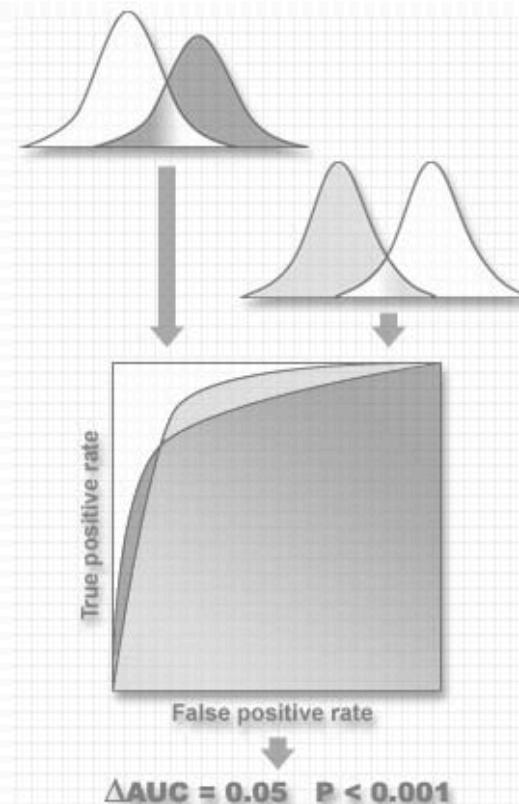
The core of the server relies on a non-parametric test for the difference of the AUC that accounts for the correlation of the ROC curves. This test takes advantage of the equality between the Mann-Whitney U-statistic for comparing distributions and the AUC when computed by the trapezoidal rule.

For more details about the statistical method implemented here, please read the following manuscript:

Vergara, I.A., Norambuena, T., Ferrada, E., Slater, A.W. and Melo, F. (2007) *StAR: a web tool for the statistical analyses of ROC curves*. *BMC Bioinformatics* (submitted).

If you use this server in your work and find it useful, please acknowledge it just by citing the reference above.

ROC ANALYSIS



This is the end of the StAR web server tutorial for
ROC Analysis
Any comments or inquiries, please contact us.