

# Package ‘sscore’

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**Title** S-Score Algorithm for Affymetrix Oligonucleotide Microarrays

**Author** Richard Kennedy <rkennedy@ms.soph.uab.edu>, based on C++ code from Li Zhang <zhangli@odin.mdacc.tmc.edu> and Borland Delphi code from Robnet Kerns <rtkerns@vcu.edu>.

**Maintainer** Richard Kennedy <rkennedy@ms.soph.uab.edu>

**Depends** R (>= 1.8.0), affy, affyio

**Suggests** affydata

**Description** This package contains an implementation of the S-Score algorithm as described by Zhang et al (2002).

**License** GPL (>= 2)

**URL** <http://home.att.net/~richard-kennedy/professional.html>

**biocViews** DifferentialExpression

## R topics documented:

computeAffxRawQ . . . . .	2
computeAffxSFandSDT . . . . .	3
computeOutlier . . . . .	4
computeRawQ . . . . .	5
computeSFandSDT . . . . .	6
computeZoneIInfo . . . . .	8
computeZonenoise . . . . .	9
OneStepBiweightAlgorithm . . . . .	10
SScore . . . . .	11
SScoreBatch . . . . .	13
trimMean . . . . .	15

<b>Index</b>	<b>16</b>
--------------	-----------

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computeAffxRawQ	<i>Computes RawQ using affxparser routines</i>
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**Description**

Computes the RawQ value of a single Affymetrix GeneChip

**Usage**

```
computeAffxRawQ(intensity, stdvs, pixels, probe.index, probe.zoneID, bgCells, NumberZones)
```

**Arguments**

intensity	vector of intensities for the GeneChip
stdvs	matrix of standard deviations for probe intensities from *.CEL file
pixels	matrix of number of pixels for probe intensities from *.CEL file
probe.index	vector of indices for each probe
probe.zoneID	vector of zone ID numbers for each probe
bgCells	number of background cells for the GeneChip
NumberZones	number of zones on the GeneChip

**Details**

Calculates RawQ using the algorithms described in the Affymetrix Statistical Algorithms Description Document for a single GeneChip. This is an internal function that will generally not be accessed directly.

**Value**

the RawQ value for the given array

**Note**

Based on Affymetrix MAS5 Statistical SDK source code [http://www.affymetrix.com/Auth/support/developer/stat\\_sdk/STAT\\_SDK\\_source.zip](http://www.affymetrix.com/Auth/support/developer/stat_sdk/STAT_SDK_source.zip), as well as C++ code by Li Zhang and Delphi code by Robnet Kerns

**Author(s)**

Richard Kennedy <rkennedy@vcu.edu>

**References**

Affymetrix (2002) Statistical Algorithms Description Document, Affymetrix Inc., Santa Clara, CA, whitepaper. [http://www.affymetrix.com/support/technical/whitepapers/sadd\\_whitepaper.pdf](http://www.affymetrix.com/support/technical/whitepapers/sadd_whitepaper.pdf)

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computeAffxSFandSDT     *Compute SF and SDT values using affxparser routines*

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### Description

Computes the scaling factor (SF) and statistical difference threshold (SDT) values of Affymetrix GeneChips, for use in calculating S-Score values

### Usage

```
computeAffxSFandSDT(afbatch, stdvs, pixels, TGT = 500, digits = NULL, verbose = FALSE, plot.histogram =
```

### Arguments

afbatch	An AffyBatch object
stdvs	matrix of standard deviations for probe intensities from *.CEL file
pixels	matrix of number of pixels for probe intensities from *.CEL file
TGT	the target intensity to which the arrays should be scaled
digits	number of significant digits for SF and SDT values
verbose	logical value. If TRUE it provides more detail of the SF and SDT calculations.
plot.histogram	logical value. if TRUE it plots a histogram of intensities

### Details

Calculates SF and SDT factors using the algorithms described in the Affymetrix Statistical Algorithms Description Document. The SF and SDT may be used in the calculation of S-Score values, or may be useful in their own right. One SF and SDT value is calculated for each GeneChip, which are arranged in the same order as the columns in the AffyBatch object.

### Value

computeSFandSDT returns a list containing the following components:

SF	SF values, one for each GeneChip
SDT	SDT values, one for each GeneChip

### Note

Based on Affymetrix MAS5 Statistical SDK source code [http://www.affymetrix.com/Auth/support/developer/stat\\_sdk/STAT\\_SDK\\_source.zip](http://www.affymetrix.com/Auth/support/developer/stat_sdk/STAT_SDK_source.zip), as well as C++ code by Li Zhang and Delphi code by Robnet Kerns

### Author(s)

Richard Kennedy <rkennedy@vcu.edu>

## References

Affymetrix (2002) Statistical Algorithms Description Document, Affymetrix Inc., Santa Clara, CA, whitepaper. [http://www.affymetrix.com/support/technical/whitepapers/sadd\\_whitepaper.pdf](http://www.affymetrix.com/support/technical/whitepapers/sadd_whitepaper.pdf)

## Examples

```
if (length(dir(pattern=".cel$")) != 0) {

  ## Read in the *.CEL files
  abatch <- ReadAffy()

  ## compute SF and SDT
  SfSdt <- computeSFandSDT(abatch)

  ## show verbose output
  SfSdt <- computeSFandSDT(abatch, verbose=TRUE)

  ## plot PM and MM histograms for each *.CEL file
  SfSdt <- computeSFandSDT(abatch, plot.histogram=TRUE)

}
```

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computeOutlier	<i>Compute outlier probes</i>
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## Description

Computes outlier and/or mask probes for a set of Affymetrix GeneChips that will be excluded from S-Score calculations

## Usage

```
computeOutlier(afbatch, rm.mask = TRUE, rm.outliers = TRUE, rm.extra = TRUE, celfile.path = NULL, celfile.names = NULL)
```

## Arguments

afbatch	An AffyBatch object
rm.mask	should the spots marked as 'MASKS' be excluded from S-Score calculation?
rm.outliers	should the spots marked as 'OUTLIERS' be excluded from S-Score calculation?
rm.extra	if TRUE, overrides what is in rm.mask and rm.outliers
celfile.path	character denoting the path for the *.CEL files corresponding to afbatch
celfile.names	optional character vector containing the names of the *.CEL files

**Details**

Computes the outlier and / or mask probes for an AffyBatch object. These are returned in matrix form, with one probe per row and one chip per column. The value of each location in the matrix will be TRUE if the corresponding probe is an outlier / masked value and FALSE if it is not. The options may be set to exclude only outlier values, only mask values, or both. The probes are arranged in the same row order as the intensity values. Note that this function assumes the \*.CEL files are still available in the directory given by `celfile.path` (or the current directory if `celfile.path` is not specified). The \*.CEL names are given by `celfile.names`. If `celfile.names` is not specified, the sample names from the AffyBatch object will be used.

**Value**

a matrix containing the list of outliers / masked values for the given AffyBatch object.

**Note**

Based on C++ code by Li Zhang and Delphi code by Robnet Kerns

**Author(s)**

Richard Kennedy <rkennedy@vcu.edu>

**Examples**

```
if (length(dir(pattern=".cel$")) != 0) {
  abatch <- ReadAffy()
  outlier <- computeOutlier(abatch)
}
```

---

computeRawQ

*Computes RawQ*

---

**Description**

Computes the RawQ value of a single Affymetrix GeneChip

**Usage**

```
computeRawQ(fname, intensity, probe.index, probe.zoneID, bgCells, NumberZones, celfile.path = NULL)
```

**Arguments**

<code>fname</code>	character string with the filename of the GeneChip
<code>intensity</code>	vector of intensities for the GeneChip
<code>probe.index</code>	vector of indices for each probe
<code>probe.zoneID</code>	vector of zone ID numbers for each probe
<code>bgCells</code>	number of background cells for the GeneChip

NumberZones      number of zones on the GeneChip  
 celfile.path      character denoting the path for the \*.CEL files specified in fname

### Details

Calculates RawQ using the algorithms described in the Affymetrix Statistical Algorithms Description Document for a single GeneChip. This is an internal function that will generally not be accessed directly.

### Value

the RawQ value for the given array

### Note

Based on Affymetrix MAS5 Statistical SDK source code [http://www.affymetrix.com/Auth/support/developer/stat\\_sdk/STAT\\_SDK\\_source.zip](http://www.affymetrix.com/Auth/support/developer/stat_sdk/STAT_SDK_source.zip), as well as C++ code by Li Zhang and Delphi code by Robnet Kerns

### Author(s)

Richard Kennedy <rkennedy@vcu.edu>

### References

Affymetrix (2002) Statistical Algorithms Description Document, Affymetrix Inc., Santa Clara, CA, whitepaper. [http://www.affymetrix.com/support/technical/whitepapers/sadd\\_whitepaper.pdf](http://www.affymetrix.com/support/technical/whitepapers/sadd_whitepaper.pdf)

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computeSFandSDT	<i>Compute SF and SDT values</i>
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### Description

Computes the scaling factor (SF) and statistical difference threshold (SDT) values of Affymetrix GeneChips, for use in calculating S-Score values

### Usage

```
computeSFandSDT(afbatch, TGT = 500, digits = NULL, verbose = FALSE, plot.histogram = FALSE, celfile.pat
```

### Arguments

afbatch	An AffyBatch object
TGT	the target intensity to which the arrays should be scaled
digits	number of significant digits for SF and SDT values
verbose	logical value. If TRUE it provides more detail of the SF and SDT calculations.
plot.histogram	logical value. if TRUE it plots a histogram of intensities
celfile.path	character denoting the path for the *.CEL files corresponding to afbatch

**Details**

Calculates SF and SDT factors using the algorithms described in the Affymetrix Statistical Algorithms Description Document. The SF and SDT may be used in the calculation of S-Score values, or may be useful in their own right. One SF and SDT value is calculated for each GeneChip, which are arranged in the same order as the columns in the AffyBatch object.

**Value**

computeSFandSDT returns a list containing the following components:

SF	SF values, one for each GeneChip
SDT	SDT values, one for each GeneChip

**Note**

Based on Affymetrix MAS5 Statistical SDK source code [http://www.affymetrix.com/Auth/support/developer/stat\\_sdk/STAT\\_SDK\\_source.zip](http://www.affymetrix.com/Auth/support/developer/stat_sdk/STAT_SDK_source.zip), as well as C++ code by Li Zhang and Delphi code by Robnet Kerns

**Author(s)**

Richard Kennedy <rkennedy@vcu.edu>

**References**

Affymetrix (2002) Statistical Algorithms Description Document, Affymetrix Inc., Santa Clara, CA, whitepaper. [http://www.affymetrix.com/support/technical/whitepapers/sadd\\_whitepaper.pdf](http://www.affymetrix.com/support/technical/whitepapers/sadd_whitepaper.pdf)

**Examples**

```
if (length(dir(pattern=".cel$")) != 0) {  
  
  ## Read in the *.CEL files  
  abatch <- ReadAffy()  
  
  ## compute SF and SDT  
  SfSdt <- computeSFandSDT(abatch)  
  
  ## show verbose output  
  SfSdt <- computeSFandSDT(abatch, verbose=TRUE)  
  
  ## plot PM and MM histograms for each *.CEL file  
  SfSdt <- computeSFandSDT(abatch, plot.histogram=TRUE)  
  
}
```

---

computeZoneIInfo	<i>Compute zone background and noise</i>
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---

**Description**

Computes the background and noise for a given zone of a single Affymetrix GeneChip

**Usage**

```
computeZoneIInfo(ZoneInfo, NumberBGCells)
```

**Arguments**

ZoneInfo	vector of intensities in a given zone
NumberBGCells	number of background cells for the GeneChip

**Details**

Calculates background and noise for a zone using the algorithms described in the Affymetrix Statistical Algorithms Description Document. This is an internal function that will generally not be accessed directly.

**Value**

computeZoneIInfo returns a list containing the following components:

background	background value for the given zone
noise	noise value for the given zone

**Note**

Based on Affymetrix MAS5 Statistical SDK source code [http://www.affymetrix.com/Auth/support/developer/stat\\_sdk/STAT\\_SDK\\_source.zip](http://www.affymetrix.com/Auth/support/developer/stat_sdk/STAT_SDK_source.zip), as well as C++ code by Li Zhang and Delphi code by Robnet Kerns

**Author(s)**

Richard Kennedy <[rkennedy@vcu.edu](mailto:rkennedy@vcu.edu)>

**References**

Affymetrix (2002) Statistical Algorithms Description Document, Affymetrix Inc., Santa Clara, CA, whitepaper. [http://www.affymetrix.com/support/technical/whitepapers/sadd\\_whitepaper.pdf](http://www.affymetrix.com/support/technical/whitepapers/sadd_whitepaper.pdf)



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computeZonenoise	<i>Computes zone noise</i>
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**Description**

Computes the noise (average standard error) of the probe intensities for a single Affymetrix GeneChip

**Usage**

```
computeZonenoise(index, intensity, stdv, npixels, bgCells)
```

**Arguments**

index	vector of indices for probes in the given zone
intensity	vector of intensities for the GeneChip
stdv	vector of standard deviations for the GeneChip
npixels	vector containing number of pixels for each probe of the GeneChip
bgCells	number of background cells on the GeneChip

**Details**

Calculates the noise (average standard error) of the probes in a given zone, using the algorithms described in the Affymetrix Statistical Algorithms Description Document, for a single GeneChip. This is an internal function that will generally not be accessed directly.

**Value**

the noise of the probes for the given array

**Note**

Based on Affymetrix MAS5 Statistical SDK source code [http://www.affymetrix.com/Auth/support/developer/stat\\_sdk/STAT\\_SDK\\_source.zip](http://www.affymetrix.com/Auth/support/developer/stat_sdk/STAT_SDK_source.zip), as well as C++ code by Li Zhang and Delphi code by Robnet Kerns

**Author(s)**

Richard Kennedy <[rkennedy@vcu.edu](mailto:rkennedy@vcu.edu)>

**References**

Affymetrix (2002) Statistical Algorithms Description Document, Affymetrix Inc., Santa Clara, CA, whitepaper. [http://www.affymetrix.com/support/technical/whitepapers/sadd\\_whitepaper.pdf](http://www.affymetrix.com/support/technical/whitepapers/sadd_whitepaper.pdf)

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OneStepBiweightAlgorithm

*One-step Tukey's biweight*

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### Description

Computes one-step Tukey's biweight on a vector. Note that this implementation follows the Affymetrix code, which is different from the Tukey's biweight computed by the affy package.

### Usage

```
OneStepBiweightAlgorithm(x, c, epsilon)
```

### Arguments

x	vector of data
c	tuning constant (see details)
epsilon	fuzz value to avoid division by zero (see details)

### Details

The details can be found in the given reference.

### Value

A numeric value

### Note

Based on Affymetrix MAS5 Statistical SDK source code [http://www.affymetrix.com/Auth/support/developer/stat\\_sdk/STAT\\_SDK\\_source.zip](http://www.affymetrix.com/Auth/support/developer/stat_sdk/STAT_SDK_source.zip)

### Author(s)

Richard Kennedy <[rkennedy@vcu.edu](mailto:rkennedy@vcu.edu)>

### References

Affymetrix (2002) Statistical Algorithms Description Document, Affymetrix Inc., Santa Clara, CA, whitepaper. [http://www.affymetrix.com/support/technical/whitepapers/sadd\\_whitepaper.pdf](http://www.affymetrix.com/support/technical/whitepapers/sadd_whitepaper.pdf)

---

SScore	<i>Compute S-Score values</i>
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**Description**

Computes the S-Score values for a pair of Affymetrix GeneChips

**Usage**

```
SScore(afbatch = stop("No CEL files specified"), classlabel = c(0,1), SF = NULL,
       SDT = NULL, rm.outliers = TRUE, rm.mask = TRUE, rm.extra = NULL,
       digits = NULL, verbose = FALSE, celfile.path = NULL, celfile.names = NULL)
```

**Arguments**

afbatch	An AffyBatch object
classlabel	A vector identifying the class for each column of the AffyBatch object
SF	a list of Scale Factor (SF) values for each GeneChip
SDT	a list of Standard Difference Threshold (SDT) values for each GeneChip
rm.outliers	should the spots marked as 'OUTLIERS' be excluded from S-Score calculation?
rm.mask	should the spots marked as 'MASKS' be excluded from S-Score calculation?
rm.extra	if TRUE, overrides what is in rm.mask and rm.outliers
digits	number of significant digits for S-Score values
verbose	logical value. If TRUE it provides more detail of the S-Score calculations.
celfile.path	character denoting the path for the *.CEL files corresponding to afbatch
celfile.names	optional character vector containing the names of the *.CEL files

**Details**

Computes S-Score values as described by Zhang et al. (2002). SScore provides a simpler interface for comparing only two classes of GeneChips, while SScoreBatch compares multiple pairs of chips.

The classlabel consists of a vector with one entry for each column of the AffyBatch object. Each entry consists of a 0 or a 1 to identify the class to which the chip for the corresponding column belongs. SScore will conduct a two-class test comparing all chips labeled 0 to all chips labeled 1. If classlabel is not specified, it defaults to a two-chip comparison, compatible with previous versions of SScore.

The SF and SDT factors are required for all calculations. If NULL, these values will be calculated according to the Affymetrix Statistical Algorithms Description Document. digits allows the specification of the number of significant digits for the S-Score values; if NULL, the maximum number of significant digits are retained.

**Value**

An ExpressionSet with S-Score values in the exprs slot.

**Note**

Based on C++ code by Li Zhang and Delphi code by Robnet Kerns

**Author(s)**

Richard Kennedy <rkennedy@vcu.edu>

**References**

Zhang, L., Wang, L., Ravindranathan, A., Miles, M.F. (2002) A new algorithm for analysis of oligonucleotide arrays: application to expression profiling in mouse brain regions. *Journal of Molecular Biology*, 317(2), pp. 225–35

Kerns, R.T., Zhang, L., Miles, M.F. (2003) Application of the S-score algorithm for analysis of oligonucleotide microarrays. *Methods*, 31(4), pp. 274–81

**See Also**

[SScoreBatch](#), [computeSFandSDT](#), [computeOutlier](#)

**Examples**

```
if (length(dir(pattern=".cel$")) != 0) {  
  
  ## Read in the *.CEL files  
  abatch <- ReadAffy()  
  
  ## default calling method  
  SScores <- SScore(abatch)  
  
  ## specifying SF and SDT (gives same results as above)  
  SfSdt <- computeSFandSDT(abatch)  
  SScores <- SScore(abatch, SF=SfSdt$SF, SDT=SfSdt$SDT)  
  
  ## specifying outlier and masked values should be included in calculations  
  SScores <- SScore(abatch, rm.outliers=FALSE, rm.mask=FALSE)  
  
  ## round results to 3 significant digits  
  SScores <- SScore(abatch, digits=3)  
  
  ## show verbose output  
  SScores <- SScore(abatch, verbose=TRUE)  
  
}
```

---

SScoreBatch	<i>Compute S-Score values</i>
-------------	-------------------------------

---

**Description**

Computes the S-Score values for multiple pairs of Affymetrix GeneChips

**Usage**

```
SScoreBatch(afbatch = stop("No CEL files specified"), compare = stop("No list of comparisons given"),
            SF = NULL, SDT = NULL, rm.outliers = TRUE, rm.mask = TRUE, rm.extra = NULL,
            digits = NULL, verbose = FALSE, celfile.path = NULL, celfile.names = NULL)
```

**Arguments**

afbatch	An AffyBatch object
compare	A matrix describing which chips to compare
SF	a list of Scale Factor (SF) values for each GeneChip
SDT	a list of Standard Difference Threshold (SDT) values for each GeneChip
rm.outliers	should the spots marked as 'OUTLIERS' be excluded from S-Score calculation?
rm.mask	should the spots marked as 'MASKS' be excluded from S-Score calculation?
rm.extra	if TRUE, overrides what is in rm.mask and rm.outliers
digits	number of significant digits for S-Score values
verbose	logical value. If TRUE it provides more detail of the S-Score calculations.
celfile.path	character denoting the path for the *.CEL files corresponding to afbatch
celfile.names	optional character vector containing the names of the *.CEL files

**Details**

Computes S-Score values as described by Zhang et al. (2002). SScoreBatch allows comparison of multiple pairs of chips, while SScore provides a simpler interface when comparing only two GeneChips.

compare specifies how the pairwise comparisons are performed. It is an N x 2 matrix, where N is the number of pairwise comparisons; each row of the matrix contains index in the AffyBatch object for the chips to be compared. For example,

```
1 3
4 2
5 9
10 2
5 7
```

would do a comparison of chip 1 to chip 3, a comparison of chip 4 to chip 2, a comparison of chip 5 to chip 9, and so on. The columns in ExpressionSet correspond to the rows of compare, so that the results of the first comparison are in column 1, the results of the second comparison are in column 2, and so on.

The SF and SDT factors are required for all calculations. If NULL, these values will be calculated according to the Affymetrix Statistical Algorithms Description Document. probes.digits allows the specification of the number of significant digits for the S-Score values; if NULL, the maximum number of significant digits are retained.

### Value

An ExpressionSet with S-Score values in the exprs slot.

### Note

Based on C++ code by Li Zhang and Delphi code by Robnet Kerns

### Author(s)

Richard Kennedy <rkennedy@vcu.edu>

### References

Zhang, L., Wang, L., Ravindranathan, A., Miles, M.F. (2002) A new algorithm for analysis of oligonucleotide arrays: application to expression profiling in mouse brain regions. *Journal of Molecular Biology*, 317(2), pp. 225–35

Kerns, R.T., Zhang, L., Miles, M.F. (2003) Application of the S-score algorithm for analysis of oligonucleotide microarrays. *Methods*, 31(4), pp. 274–81

### See Also

[SScore](#), [computeSFandSDT](#), [computeOutlier](#)

### Examples

```
if (length(dir(pattern=".cel$")) != 0) {

  ## Read in the *.CEL files
  abatch <- ReadAffy()

  ## default calling method
  SScores <- SScoreBatch(abatch)

  ## specifying SF and SDT (gives same results as above)
  SfSdt <- computeSFandSDT(abatch)

  ## specifying outlier and masked values should be included in calculations
  SScores <- SScoreBatch(abatch, SF=SfSdt$SF, SDT=SfSdt$SDT)
  SScores <- SScoreBatch(abatch, rm.outliers=FALSE, rm.mask=FALSE)
```

```
## round results to 3 significant digits
SScores <- SScoreBatch(abatch,digits=3)

## show verbose output
SScores <- SScoreBatch(abatch,verbose=TRUE)

}
```

---

trimMean	<i>Compute trimmed mean for a vector</i>
----------	--

---

### Description

Computes the trimmed mean for a vector. Note that this implementation follows the Affymetrix code, which gives different results than the standard R function `mean()`.

### Usage

```
trimMean(vec, p1, p2)
```

### Arguments

vec	vector of values
p1	lower percentage for trimming
p2	upper percentage for trimming

### Details

The details can be found in the given reference.

### Value

A numeric value

### Note

Based on Affymetrix MAS5 Statistical SDK source code [http://www.affymetrix.com/Auth/support/developer/stat\\_sdk/STAT\\_SDK\\_source.zip](http://www.affymetrix.com/Auth/support/developer/stat_sdk/STAT_SDK_source.zip)

### Author(s)

Richard Kennedy <[rkennedy@vcu.edu](mailto:rkennedy@vcu.edu)>

### References

Affymetrix (2002) Statistical Algorithms Description Document, Affymetrix Inc., Santa Clara, CA, whitepaper. [http://www.affymetrix.com/support/technical/whitepapers/sadd\\_whitepaper.pdf](http://www.affymetrix.com/support/technical/whitepapers/sadd_whitepaper.pdf)

# Index

## \*Topic **manip**

- computeAffxRawQ, [2](#)
- computeAffxSFandSDT, [3](#)
- computeOutlier, [4](#)
- computeRawQ, [5](#)
- computeSFandSDT, [6](#)
- computeZoneIInfo, [8](#)
- computeZonenoise, [9](#)
- OneStepBiweightAlgorithm, [10](#)
- SScore, [11](#)
- SScoreBatch, [13](#)

## \*Topic **univar**

- trimMean, [15](#)

- computeAffxRawQ, [2](#)
- computeAffxSFandSDT, [3](#)
- computeOutlier, [4](#), [12](#), [14](#)
- computeRawQ, [5](#)
- computeSFandSDT, [6](#), [12](#), [14](#)
- computeZoneIInfo, [8](#)
- computeZonenoise, [9](#)

OneStepBiweightAlgorithm, [10](#)

SScore, [11](#), [14](#)  
SScoreBatch, [12](#), [13](#)

trimMean, [15](#)