

# Package ‘iCheck’

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**Type** Package

**Title** QC Pipeline and Data Analysis Tools for High-Dimensional  
Illumina mRNA Expression Data

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scatterplot3d

**Suggests**

**biocViews** GeneExpression, DifferentialExpression, Microarray,  
Preprocessing, DNAMethylation, OneChannel, TwoChannel,  
QualityControl

**Description** QC pipeline and data analysis tools for high-dimensional  
Illumina mRNA expression data.

**License** GPL (>= 2)

**NeedsCompilation** no

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genExprSet	<i>Generate an ExpressionSet object</i>
------------	---

---

## Description

Generate a simple ExpressionSet object.

## Usage

```
genExprSet(
  ex,
  pDat,
  fDat = NULL,
  annotation = "lumiHumanAll.db")
```

## Arguments

ex	A matrix of expression levels. Rows are gene probes and columns are arrays.
pDat	A data frame describing arrays. Rows are arrays and columns are variables describing arrays. The row names of pDat must be the same as the column of ex.
fDat	A data frame describing gene probes. Rows are gene probes and columns are variables describing gene probes. The rownames of fDat must be the same as that of ex.
annotation	character string. Indicating the annotation library (e.g. lumiHumanAll.db for the gene probes).

## Value

an ExpressionSet object.

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---

genSimData.BayesNormal

*Generating simulated data set from conditional normal distributions*

---

**Description**

Generating simulated data set from conditional normal distributions.

**Usage**

```
genSimData.BayesNormal(
  nCpGs,
  nCases,
  nControls,
  mu.n = -2,
  mu.c = 2,
  d0 = 20,
  s02 = 0.64,
  s02.c = 1.5,
  testPara = "var",
  outlierFlag = FALSE,
  eps = 0.001,
  applier = lapply)
```

**Arguments**

nCpGs	integer. Number of genes.
nCases	integer. Number of cases.
nControls	integer. Number of controls.
mu.n	numeric. mean of the conditional normal distribution for controls. See details.
mu.c	numeric. mean of the conditional normal distribution for cases. See details.
d0	integer. degree of freedom for scale-inverse chi squared distribution. See details.
s02	numeric. scaling parameter for scale-inverse chi squared distribution for controls. See details.
s02.c	numeric. scaling parameter for scale-inverse chi squared distribution for cases. See details.
testPara	character string. indicating if the test is for testing equal mean, equal variance, or both.

outlierFlag	logical. indicating if outliers would be generated. If outlierFlag=TRUE, then we followed Phipson and Oshlack's (2014) simulation studies to generate one outlier for each CpG site by replacing the DNA methylation level of one diseased subject by the maximum of the DNA methylation levels of all CpG sites.
eps	numeric. if $ mean0 - mean1  < eps$ then we regard $mean0 = mean1$ . Similarly, if $ var0 - var1  < eps$ then we regard $var0 = var1$ . $mean0$ and $var0$ are the mean and variance of the chi squared distribution for controls. $mean1$ and $var1$ are the mean and variance of the chi squared distribution for cases.
applier	function name to do apply operation.

### Details

Based on Phipson and Oshlack's (2014) simulation algorithm. For each CpG site, variance of the DNA methylation was first sampled from a scaled inverse chi-squared distribution with degree of freedom  $d_0$  and scaling parameter  $s_0^2$ :  $\sigma_i^2 \text{ scale} - \text{inv}\chi^2(d_0, s_0^2)$ . M value for each CpG was then sampled from a normal distribution with mean  $\mu_n$  and variance equal to the simulated variance  $\sigma_i^2$ . For cases, the variance was first generated from  $\sigma_{i,c}^2 \text{ scale} - \text{inv}\chi^2(d_0, s_{0,c}^2)$ . M value for each CpG was then sampled from a normal distribution with mean  $\mu_c$  and variance equal to the simulated variance  $\sigma_{i,c}^2$ .

### Value

An ExpressionSet object. The phenotype data of the ExpressionSet object contains 2 columns: arrayID (array id) and memSubj (subject membership, i.e., case (memSubj=1) or control (memSubj=0)). The feature data of the ExpressionSet object contains 4 elements: probe (probe id), gene (psuedo gene symbol), chr (psuedo chromosome number), and memGenes (indicating if a gene is differentially expressed (when testPara="mean") or indicating if a gene is differentially variable (when testPara="var") ).

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### References

Phipson B, Oshlack A. DiffVar: A new method for detecting differential variability with application to methylation in cancer and aging. *Genome Biol* 2014; 15:465

### Examples

```
# generate simulated data set from conditional normal distribution
set.seed(1234567)
es.sim = genSimData.BayesNormal(nCpGs = 100,
  nCases = 20, nControls = 20,
  mu.n = -2, mu.c = 2,
  d0 = 20, s02 = 0.64, s02.c = 1.5, testPara = "var",
  outlierFlag = FALSE,
  eps = 1.0e-3, applier = lapply)
```

```
print(es.sim)
```

---

getPCAFunc

*Get principal components of arrays*


---

### Description

Get principal components of arrays.

### Usage

```
getPCAFunc(es,
            labelVariable = "subjID",
            hybName = "Hybridization_Name",
            requireLog2 = TRUE,
            corFlag = FALSE
          )
```

### Arguments

es	An ExpressionSet object
labelVariable	A character string. The name of a phenotype data variable use to label the arrays in the boxplots. By default, labelVariable = "subjID" which is equivalent to labelVariable = "Hybridization_Name".
hybName	character string. indicating the phenotype variable Hybridization_Name.
requireLog2	logical. requiredLog2=TRUE indicates probe expression levels will be log2 transformed. Otherwise, no transformation will be performed.
corFlag	logical. Indicating if correlation matrix (corFlag=TRUE) or covariance (corFlag=FALSE) is used to obtain principal components.

### Value

A list with 3 elements:

es.s	An ExpressionSet object with the arrays sorted according to Batch_Run_Date, Chip_Barcode, and Chip_Address
pcs	An object returned by the function prcomp of the R package stats. It contains the following components. sdev (the square roots of the eigenvalues of the covariance/correlation matrix); rotation (a matrix whose columns contain the eigenvectors); x (a matrix whose columns contain principal components); center (the centering used or FALSE); scale (the scale used or FALSE)
requireLog2	logical. The same value as the input requireLog2.

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**Examples**

```
# generate simulated data set from conditional normal distribution
set.seed(1234567)
es.sim = genSimData.BayesNormal(nCpGs = 100,
  nCases = 20, nControls = 20,
  mu.n = -2, mu.c = 2,
  d0 = 20, s02 = 0.64, s02.c = 1.5, testPara = "var",
  outlierFlag = FALSE,
  eps = 1.0e-3, applier = lapply)
print(es.sim)

pca.obj = getPCAFunc(es = es.sim,
  labelVariable = "subjID",
  hybName = "memSubj",
  requireLog2 = FALSE,
  corFlag = FALSE
)
```

---

glmWrapper

*Perform glm test for all gene probes*


---

**Description**

Perform glm test for all gene probes.

**Usage**

```
glmWrapper(es,
  formula = FEV1 ~ xi + age + gender,
  pos.var.interest = 1,
  family = gaussian,
  logit = FALSE,
  pvalAdjMethod = "fdr",
  alpha = 0.05,
  probeID.var = "ProbeID",
  gene.var = "Symbol",
  chr.var = "Chromosome",
  applier = lapply,
  verbose = TRUE)
```

**Arguments**

es	An LumiBatch object. fData(es) should contains information about probe ID, chromosome number and gene symbol.
formula	An object of class formula. The left handside of ~ is the response variable. Gene probe must be represented by the variable xi. For example, xi~age+gender (gene probe is the response variable); Or FEV1~xi+age+gender (gene probe is the predictor).
pos.var.interest	integer. Indicates which covariate in the right-hand-side of ~ of formula is of the interest. pos.var.interest = 0 means the intercept is of the interest. If the covariate of the interest is an factor or interaction term with more than 2 levels, the smallest p-value will represent the pvalue for the covariate of the interest.
family	By default is gaussian. refer to <a href="#">glm</a> .
logit	logical. Indicate if the gene probes will be logit transformed. For example, for DNA methylation data, one might want to logit transformation for the beta-value ( <i>methyalted/(methyalted + unmethyalted)</i> ).
pvalAdjMethod	One of p-value adjustment methods provided by the R function p.adjust in R package stats: "holm", "hochberg", "hommel", "bonferroni", "BH", "BY", "fdr", "none".
alpha	Significance level. A test is claimed to be significant if the adjusted p-value < alpha.
probeID.var	character string. Name of the variable indicating probe ID in feature data set.
gene.var	character string. Name of the variable indicating gene symbol in feature data set.
chr.var	character string. Name of the variable indicating chromosome number in feature data set.
applier	By default, it is lapply. If the library multicore is available, can use mclapply to replace lapply.
verbose	logical. Determine if intermediate output need to be suppressed. By default verbose=TRUE, intermediate output will be printed.

**Details**

This function applies R function `glm` for each gene probe.

**Value**

A list with the following elements:

n.sig	Number of significant tests after p-value adjustment.
frame	A data frame containing test results sorted according to the ascending order of unadjusted p-values for the covariate of the interest. The data frame contains 7 columns: probeIDs, geneSymbols (gene symbols of the genes where the probes come from), chr (numbers of chromosomes where the probes locate), stats (z-value), pval (p-values of the tests for the covariate of the interest), p.adj (adjusted p-values), pos (row numbers of the probes in the expression data matrix).

statMat	A matrix containing test statistics for all covariates and for all probes. Rows are probes and columns are covariates. The rows are ordered according to the ascending order of unadjusted p-values for the covariate of the interest.
pvalMat	A matrix containing p-values for all covariates and for all probes. Rows are probes and columns are covariates. The rows are ordered according to the ascending order of unadjusted p-values for the covariate of the interest.
pval.quantile	Quantiles (minimum, 25 for each covariate including intercept provided in the input argument formula.
frame.unsorted	A data frame containing test results. The data frame contains 7 columns: probeIDs, geneSymbols (gene symbols of the genes where the probes come from), chr (numbers of chromosomes where the probes locate), stats (z-value for the covariate of the interest), pval (p-values of the tests for the covariate of the interest), p.adj (adjusted p-values), pos (row numbers of the probes in the expression data matrix).
statMat.unsorted	A matrix containing test statistics for all covariates and for all probes. Rows are probes and columns are covariates.
pvalMat.unsorted	A matrix containing p-values for all covariates and for all probes. Rows are probes and columns are covariates.
memGenes	A numeric vector indicating the cluster membership of probes (unsorted). memGenes[i]=1 if the <i>i</i> -th probe is significant (adjusted pvalue < alpha) with positive z-value for the covariate of the interest; memGenes[i]=2 if the <i>i</i> -th probe is nonsignificant ; memGenes[i]=3 if the <i>i</i> -th probe is significant with negative z-value for the covariate of the interest;
memGenes2	A numeric vector indicating the cluster membership of probes (unsorted). memGenes2[i]=1 if the <i>i</i> -th probe is significant (adjusted pvalue < alpha). memGenes2[i]=0 if the <i>i</i> -th probe is nonsignificant.
mu1	Mean expression levels for arrays for probe cluster 1 (average taking across all probes with memGenes value equal to 1.
mu2	Mean expression levels for arrays for probe cluster 2 (average taking across all probes with memGenes value equal to 2.
mu3	Mean expression levels for arrays for probe cluster 3 (average taking across all probes with memGenes value equal to 3.
resMat	A matrix with $2p$ columns, where $p$ is the number of covariates (including intercept; for a nominal variable with 3 levels say, there were 2 dummy covariates). The first $p$ columns are p-values. The remaining $p$ columns are test statistics.

### Note

If the covariate of the interest is a factor or interaction term with more than 2 levels, then the p-value of the likelihood ratio test might be more appropriate than the smallest p-value for the covariate of the interest.

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**Examples**

```
# generate simulated data set from conditional normal distribution
set.seed(1234567)
es.sim = genSimData.BayesNormal(nCpGs = 100,
  nCases = 20, nControls = 20,
  mu.n = -2, mu.c = 2,
  d0 = 20, s02 = 0.64, s02.c = 1.5, testPara = "var",
  outlierFlag = FALSE,
  eps = 1.0e-3, applier = lapply)
print(es.sim)

res.glm = glmWrapper(
  es = es.sim,
  formula = xi~as.factor(memSubj),
  pos.var.interest = 1,
  family = gaussian,
  logit = FALSE,
  pvalAdjMethod = "fdr",
  alpha = 0.05,
  probeID.var = "probe",
  gene.var = "gene",
  chr.var = "chr",
  applier = lapply,
  verbose = TRUE)
```

---

lchrWrapper

*Perform glm test for all gene probes*


---

**Description**

Perform glm test for all gene probes.

**Usage**

```
lchrWrapper(es,
  formulaReduced = FEV1 ~ xi + gender,
  formulaFull = FEV1 ~ xi + age + gender,
  family = gaussian,
  logit = FALSE,
  pvalAdjMethod = "fdr",
  alpha = 0.05,
```

```
probeID.var = "ProbeID",
gene.var = "Symbol",
chr.var = "Chromosome",
applier = lapply,
verbose = TRUE)
```

## Arguments

<code>es</code>	An LumiBatch object. <code>fData(es)</code> should contains information about probe ID, chromosome number and gene symbol.
<code>formulaReduced</code>	An object of class <code>formula</code> . Formula for reduced model. The left handside of <code>~</code> is the response variable. Gene probe must be represented by the variable <code>xi</code> . For example, <code>xi~gender</code> (gene probe is the response variable); Or <code>FEV1~xi+gender</code> (gene probe is the predictor).
<code>formulaFull</code>	An object of class <code>formula</code> . Formula for Full model. The left handside of <code>~</code> is the response variable. Gene probe must be represented by the variable <code>xi</code> . For example, <code>xi~age+gender</code> (gene probe is the response variable); Or <code>FEV1~xi+age+gender</code> (gene probe is the predictor).
<code>family</code>	By default is <code>gaussian</code> . refer to <code>glm</code> .
<code>logit</code>	logical. Indicate if the gene probes will be logit transformed. For example, for DNA methylation data, one might want to logit transformation for the beta-value ( $methy\textit{lated}/(methy\textit{lated} + unmethy\textit{lated})$ ).
<code>pvalAdjMethod</code>	One of p-value adjustment methods provided by the R function <code>p.adjust</code> in R package <code>stats</code> : "holm", "hochberg", "hommel", "bonferroni", "BH", "BY", "fdr", "none".
<code>alpha</code>	Significance level. A test is claimed to be significant if the adjusted p-value < alpha.
<code>probeID.var</code>	character string. Name of the variable indicating probe ID in feature data set.
<code>gene.var</code>	character string. Name of the variable indicating gene symbol in feature data set.
<code>chr.var</code>	character string. Name of the variable indicating chromosome number in feature data set.
<code>applier</code>	By default, it is <code>lapply</code> . If the library <code>multicore</code> is available, can use <code>mclapply</code> to replace <code>lapply</code> .
<code>verbose</code>	logical. Determine if intermediate output need to be suppressed. By default <code>verbose=TRUE</code> , intermediate output will be printed.

## Details

This function applies R functions `lrtest` in R package `lmtree` and `glm` for each gene probe.

## Value

A list with the following elements:

`frame` A data frame containing test results sorted according to the ascending order of unadjusted p-values for the covariate of the interest. The data frame contains 8 columns: `probeIDs`, `geneSymbols` (gene symbols of the genes where the probes come from), `chr` (numbers of chromosomes where the probes locate), `Chisq` (chi square test statistic), `Df` (degree of freedom of the chisquare test statistic), `pval` (p-values of the tests for the covariate of the interest), `p.adj` (adjusted p-values), `pos` (row numbers of the probes in the expression data matrix). The rows are ordered based on the descending order of chisquare test statistic.

`frame.unsorted` A data frame containing test results. unordered frame.

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**Examples**

```
# generate simulated data set from conditional normal distribution
set.seed(1234567)
es.sim = genSimData.BayesNormal(nCpGs = 100,
  nCases = 20, nControls = 20,
  mu.n = -2, mu.c = 2,
  d0 = 20, s02 = 0.64, s02.c = 1.5, testPara = "var",
  outlierFlag = FALSE,
  eps = 1.0e-3, applier = lapply)
print(es.sim)

set.seed(1234567)
es.sim$age = rnorm(ncol(es.sim), mean=50, sd=5)
res.lkh = lkhWrapper(
  es = es.sim,
  formulaReduced = xi ~ memSubj,
  formulaFull = xi ~ memSubj + age,
  family = gaussian(),
  logit = FALSE,
  pvalAdjMethod = "fdr",
  alpha = 0.05,
  probeID.var = "probe",
  gene.var = "gene",
  chr.var = "chr",
  applier = lapply,
  verbose = TRUE)
```

**Description**

A wrapper function for the function 'lmFit' of the R Bioconductor package 'limma' for paired data.

**Usage**

```
lmFitPaired(
  esDiff,
  formula = ~1,
  pos.var.interest = 0,
  pvalAdjMethod = "fdr",
  alpha = 0.05,
  probeID.var="ProbeID",
  gene.var = "Symbol",
  chr.var = "Chromosome",
  verbose = TRUE)
```

**Arguments**

esDiff	An LumiBatch object containing log2 difference between cases and controls. fData(esDiff) should contains information about probe ID, chromosome number and gene symbol.
formula	An object of class formula. The intercept measures the effect of treatment. Other covariates measure the effects of their interaction and treatment. The p-values for the intercept will be output. No left handside of ~ should be specified since the response variable will be the expression level.
pos.var.interest	integer. Indicates which covariate on the right-hand-side of ~ in formula is the covariate of the interest. By default, it is the intercept pos.var.interest=0.
pvalAdjMethod	One of p-value adjustment methods provided by the R function p.adjust in R package stats: "holm", "hochberg", "hommel", "bonferroni", "BH", "BY", "fdr", "none".
alpha	Significance level. A test is claimed to be significant if the adjusted p-value < alpha.
probeID.var	character string. Name of the variable indicating probe ID in feature data set.
gene.var	character string. Name of the variable indicating gene symbol in feature data set.
chr.var	character string. Name of the variable indicating chromosome number in feature data set.
verbose	logical. Determine if intermediate output need to be suppressed. By default verbose=TRUE, intermediate output will be printed.

**Details**

This is a wrapper function of R Bioconductor functions `lmFit` and `eBayes` for paired data to make it easier to input design and output list of significant results.

**Value**

A list with the following elements:

<code>n.sig</code>	Number of significant tests after p-value adjustment.
<code>frame</code>	A data frame containing test results sorted according to the ascending order of unadjusted p-values for the intercept. The data frame contains 7 columns: <code>probeIDs</code> , <code>geneSymbols</code> (gene symbols of the genes where the probes come from), <code>chr</code> (numbers of chromosomes where the probes locate), <code>stats</code> (moderated t-statistics for the intercept), <code>pval</code> (p-values of the tests for the intercept), <code>p.adj</code> (adjusted p-values), <code>pos</code> (row numbers of the probes in the expression data matrix).
<code>statMat</code>	A matrix containing test statistics for all covariates and for all probes. Rows are probes and columns are covariates. The rows are ordered according to the ascending order of unadjusted p-values for the intercept.
<code>pvalMat</code>	A matrix containing pvalues for all covariates and for all probes. Rows are probes and columns are covariates. The rows are ordered according to the ascending order of unadjusted p-values for the intercept.
<code>pval.quantile</code>	Quantiles (minimum, 25 for all covariates including intercept provided in the input argument formula.
<code>frame.unsorted</code>	A data frame containing test results. The data frame contains 7 columns: <code>probeIDs</code> , <code>geneSymbols</code> (gene symbols of the genes where the probes come from), <code>chr</code> (numbers of chromosomes where the probes locate), <code>stats</code> (moderated t-statistics for the intercept), <code>pval</code> (p-values of the tests for the intercept), <code>p.adj</code> (adjusted p-values), <code>pos</code> (row numbers of the probes in the expression data matrix).
<code>statMat.unsorted</code>	A matrix containing test statistics for all covariates and for all probes. Rows are probes and columns are covariates.
<code>pvalMat.unsorted</code>	A matrix containing pvalues for all covariates and for all probes. Rows are probes and columns are covariates.
<code>memGenes</code>	A numeric vector indicating the cluster membership of probes (unsorted). <code>memGenes[i]=1</code> if the <i>i</i> -th probe is significant (adjusted pvalue < alpha) with positive moderated t-statistic; <code>memGenes[i]=2</code> if the <i>i</i> -th probe is nonsignificant ; <code>memGenes[i]=3</code> if the <i>i</i> -th probe is significant with negative moderated t-statistic;
<code>memGenes2</code>	A numeric vector indicating the cluster membership of probes (unsorted). <code>memGenes2[i]=1</code> if the <i>i</i> -th probe is significant (adjusted pvalue < alpha). <code>memGenes2[i]=0</code> if the <i>i</i> -th probe is nonsignificant.
<code>mu1</code>	Mean expression levels for arrays for probe cluster 1 (average taking across all probes with <code>memGenes</code> value equal to 1.
<code>mu2</code>	Mean expression levels for arrays for probe cluster 2 (average taking across all probes with <code>memGenes</code> value equal to 2.
<code>mu3</code>	Mean expression levels for arrays for probe cluster 3 (average taking across all probes with <code>memGenes</code> value equal to 3.
<code>ebFit</code>	object returned by R Bioconductor function <code>eBayes</code> .

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**Examples**

```
# generate simulated data set from conditional normal distribution
set.seed(1234567)
es.sim = genSimData.BayesNormal(nCpGs = 100,
  nCases = 20, nControls = 20,
  mu.n = -2, mu.c = 2,
  d0 = 20, s02 = 0.64, s02.c = 1.5, testPara = "var",
  outlierFlag = FALSE,
  eps = 1.0e-3, applier = lapply)
print(es.sim)

# although the generated data is not from
# paired design, we use it to illustrate the
# usage of the function lmFitPaired

res.limma = lmFitPaired(
  es = es.sim,
  formula = ~as.factor(memSubj),
  pos.var.interest = 0,
  pvalAdjMethod = "fdr",
  alpha = 0.05,
  probeID.var = "probe",
  gene.var = "gene",
  chr.var = "chr",
  verbose = TRUE)
```

---

lmFitWrapper

*A wrapper function for the function 'lmFit' of the R Bioconductor package 'limma'*

---

**Description**

A wrapper function for the function 'lmFit' of the R Bioconductor package 'limma'.

**Usage**

```
lmFitWrapper(
  es,
  formula = ~as.factor(gender),
  pos.var.interest = 1,
  pvalAdjMethod = "fdr",
  alpha = 0.05,
```

```

probeID.var = "ProbeID",
gene.var = "Symbol",
chr.var = "Chromosome",
verbose = TRUE)

```

### Arguments

<code>es</code>	An LumiBatch object. <code>fData(es)</code> should contains information about chromosome number and gene symbol.
<code>formula</code>	An object of class <code>formula</code> . No left handside of <code>~</code> should be specified since the response variable will be the expression level.
<code>pos.var.interest</code>	integer. Indicates which covariate on the right-hand-side of <code>~</code> in <code>formula</code> is the covariate of the interest. By default, it is the first covariate <code>pos.var.interest=1</code> .
<code>pvalAdjMethod</code>	One of p-value adjustment methods provided by the R function <code>p.adjust</code> in R package <code>stats</code> : "holm", "hochberg", "hommel", "bonferroni", "BH", "BY", "fdr", "none".
<code>alpha</code>	Significance level. A test is claimed to be significant if the adjusted p-value < alpha.
<code>probeID.var</code>	character string. Name of the variable indicating probe ID in feature data set.
<code>gene.var</code>	character string. Name of the variable indicating gene symbol in feature data set.
<code>chr.var</code>	character string. Name of the variable indicating chromosome number in feature data set.
<code>verbose</code>	logical. Determine if intermediate output need to be suppressed. By default <code>verbose=TRUE</code> , intermediate output will be printed.

### Details

This is a wrapper function of R Bioconductor functions `lmFit` and `eBayes` to make it easier to input design and output list of significant results.

### Value

A list with the following elements:

<code>n.sig</code>	Number of significant tests after p-value adjustment.
<code>frame</code>	A data frame containing test results sorted according to the ascending order of unadjusted p-values for the covariate of the interest. The data frame contains 7 columns: <code>probeIDs</code> , <code>geneSymbols</code> (gene symbols of the genes where the probes come from), <code>chr</code> (numbers of chromosomes where the probes locate), <code>stats</code> (moderated t-statistics for the covariate of interest, i.e. the first covariate), <code>\codepval</code> (p-values of the tests for the covariate of interest, i.e. the first covariate), <code>p.adj</code> (adjusted p-values), <code>pos</code> (row numbers of the probes in the expression data matrix).

statMat	A matrix containing test statistics for all covariates and for all probes. Rows are probes and columns are covariates. The rows are ordered according to the ascending order of unadjusted p-values for the covariate of the interest.
pvalMat	A matrix containing pvalues for all covariates and for all probes. Rows are probes and columns are covariates. The rows are ordered according to the ascending order of unadjusted p-values for the covariate of the interest.
pval.quantile	Quantiles (minimum, 25 for all covariates including intercept provided in the input argument formula.
frame.unsorted	A data frame containing test results. The data frame contains 7 columns: probeIDs, geneSymbols (gene symbols of the genes where the probes come from), chr (numbers of chromosomes where the probes locate), stats (moderated t-statistics for the covariate of the interest), pval (p-values of the tests for the covariate of the interest), p.adj (adjusted p-values), pos (row numbers of the probes in the expression data matrix).
statMat.unsorted	A matrix containing test statistics for all covariates and for all probes. Rows are probes and columns are covariates.
pvalMat.unsorted	A matrix containing pvalues for all covariates and for all probes. Rows are probes and columns are covariates.
memGenes	A numeric vector indicating the cluster membership of probes (unsorted). memGenes[i]=1 if the <i>i</i> -th probe is significant (adjusted pvalue < alpha) with positive moderated t-statistic; memGenes[i]=2 if the <i>i</i> -th probe is nonsignificant ; memGenes[i]=3 if the <i>i</i> -th probe is significant with negative moderated t-statistic;
memGenes2	A numeric vector indicating the cluster membership of probes (unsorted). memGenes2[i]=1 if the <i>i</i> -th probe is significant (adjusted pvalue < alpha). memGenes2[i]=0 if the <i>i</i> -th probe is nonsignificant.
mu1	Mean expression levels for arrays for probe cluster 1 (average taking across all probes with memGenes value equal to 1.
mu2	Mean expression levels for arrays for probe cluster 2 (average taking across all probes with memGenes value equal to 2.
mu3	Mean expression levels for arrays for probe cluster 3 (average taking across all probes with memGenes value equal to 3.
ebFit	object returned by R Bioconductor function eBayes.

### Author(s)

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### Examples

```
# generate simulated data set from conditional normal distribution
set.seed(1234567)
```

```

es.sim = genSimData.BayesNormal(nCpGs = 100,
  nCases = 20, nControls = 20,
  mu.n = -2, mu.c = 2,
  d0 = 20, s02 = 0.64, s02.c = 1.5, testPara = "var",
  outlierFlag = FALSE,
  eps = 1.0e-3, applier = lapply)
print(es.sim)

res.limma = lmFitWrapper(
  es = es.sim,
  formula = ~as.factor(memSubj),
  pos.var.interest = 1,
  pvalAdjMethod = "fdr",
  alpha = 0.05,
  probeID.var = "probe",
  gene.var = "gene",
  chr.var = "chr",
  verbose = TRUE)

```

---

LumiBatch2Table	<i>Output slots (exprs, pData, fData) of an LumiBatch object into 3 text files</i>
-----------------	--

---

## Description

Output slots (exprs, pData, fData) of an LumiBatch object into 3 text files.

## Usage

```

LumiBatch2Table(
  es,
  probeID.var="ProbeID",
  gene.var="Symbol",
  chr.var="Chromosome",
  sep = ",",
  quote = FALSE,
  filePrefix = "test",
  fileExt = "csv")

```

## Arguments

es	An LumiBatch object
probeID.var	character string. Name of the variable indicating probe ID in feature data set.
gene.var	character string. Name of the variable indicating gene symbol in feature data set.
chr.var	character string. Name of the variable indicating chromosome number in feature data set.

sep	Field delimiter for the output text files
quote	logical. Indicating if any character or factor. See also <a href="#">write.table</a> .
filePrefix	Prefix of the names of the output files.
fileExt	File extension of the names of the output files.

### Details

Suppose `filePrefix="test"` and `fileExt=".csv"`. Then, the file names of the 3 output files are: "test\_exprs.csv", "test\_pDat.csv", and "test\_fDat.csv", respectively.

### Value

None.

### Author(s)

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### Examples

```
# generate simulated data set from conditional normal distribution
set.seed(1234567)
es.sim = genSimData.BayesNormal(nCpGs = 100,
  nCases = 20, nControls = 20,
  mu.n = -2, mu.c = 2,
  d0 = 20, s02 = 0.64, s02.c = 1.5, testPara = "var",
  outlierFlag = FALSE,
  eps = 1.0e-3, applier = lapply)
print(es.sim)
```

```
LumiBatch2Table(
  es = es.sim,
  probeID.var="probe",
  gene.var="gene",
  chr.var="chr",
  sep = ",",
  quote = FALSE,
  filePrefix = "test",
  fileExt = "csv")
```

---

pca2DPlot                      *Scatter plot of first 2 principal components*

---

### Description

Scatter plot of first 2 principal components.

### Usage

```
pca2DPlot(pcaObj,
          plot.dim = c(1,2),
          labelVariable = "subjID",
          hybName = "Hybridization_Name",
          outFileFileName = "test_pca_raw.pdf",
          title = "Scatter plot of pcas",
          plotOutPutFlag = FALSE,
          mar = c(5, 4, 4, 2) + 0.1,
          lwd = 1.5,
          equalRange = TRUE,
          xlab = NULL,
          ylab = NULL,
          xlim = NULL,
          ylim = NULL,
          cex.legend = 1.5,
          cex = 1.5,
          cex.lab = 1.5,
          cex.axis = 1.5,
          legendPosition = "topright",
          ...)
```

### Arguments

pcaObj	An object returned by the function <code>pca</code> of the R package <code>pcaMethods</code> .
plot.dim	A vector of 2 positive-integer-value integer specifying which 2 pcas will be plot.
labelVariable	The name of a column of the phenotype data matrix. The elements of the column will replace the column names of the expression data matrix.
hybName	character string. indicating the phenotype variable <code>Hybridization_Name</code> .
outFileFileName	Name of the figure file to be created.
title	Title of the scatter plot.
plotOutPutFlag	logical. <code>plotOutPutFlag=TRUE</code> indicates the plots will be output to pdf format files. Otherwise, the plots will not be output to external files.
mar	A numerical vector of the form <code>'c(bottom, left, top, right)'</code> which gives the number of lines of margin to be specified on the four sides of the plot. The default is <code>'c(5, 4, 4, 2) + 0.1'</code> . see <a href="#">par</a> .
lwd	The line width, a <code>_positive_</code> number, defaulting to <code>'1'</code> . see <a href="#">par</a> .

equalRange	logical. Indicating if the x-axis and y-axis have the same range.
xlab	Label of x axis.
ylab	Label of y axis.
xlim	Range of x axis.
ylim	Range of y axis.
cex.legend	Font size for legend.
cex	numerical value giving the amount by which plotting text and symbols should be magnified relative to the default. see <a href="#">par</a> .
cex.lab	The magnification to be used for x and y labels relative to the current setting of cex.
cex.axis	The magnification to be used for axis annotation relative to the current setting of cex. see <a href="#">par</a> .
legendPosition	Position of legend. Possible values are “bottomright”, “bottom”, “bottomleft”, “left”, “topleft”, “top”, “topright”, “right” and “center”.
...	Arguments to be passed to <a href="#">plot</a> .

**Value**

A matrix of PCA scores. Each column corresponds to a principal component.

**Author(s)**

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**Examples**

```
# generate simulated data set from conditional normal distribution
set.seed(1234567)
es.sim = genSimData.BayesNormal(nCpGs = 100,
  nCases = 20, nControls = 20,
  mu.n = -2, mu.c = 2,
  d0 = 20, s02 = 0.64, s02.c = 1.5, testPara = "var",
  outlierFlag = FALSE,
  eps = 1.0e-3, applier = lapply)
print(es.sim)

pca.obj = getPCAFunc(es = es.sim,
  labelVariable = "subjID",
  hybName = "memSubj",
  requireLog2 = FALSE,
  corFlag = FALSE
)

pca2DPlot(pcaObj = pca.obj,
```

```

plot.dim = c(1,2),
labelVariable = "subjID",
hybName = "memSubj",
plotOutPutFlag = FALSE,
cex.legend = 0.5,
legendPosition = "topright")

```

---

pca3DPlot

*Scatter plot of 3 specified principal components*


---

### Description

Scatter plot of 3 specified principal components.

### Usage

```

pca3DPlot(pcaObj,
          plot.dim = c(1,2, 3),
          labelVariable = "subjID",
          hybName = "Hybridization_Name",
          outFileNames = "test_pca_raw.pdf",
          title = "Scatter plot of pcas",
          plotOutPutFlag = FALSE,
          mar = c(5, 4, 4, 2) + 0.1,
          lwd = 1.5,
          equalRange = TRUE,
          xlab = NULL,
          ylab = NULL,
          zlab = NULL,
          xlim = NULL,
          ylim = NULL,
          zlim = NULL,
          cex.legend = 1.5,
          cex = 1.5,
          cex.lab = 1.5,
          cex.axis = 1.5,
          legendPosition = "topright",
          ...)

```

### Arguments

pcaObj	An object returned by the function <code>pca</code> of the R package <code>pcaMethods</code> .
plot.dim	A vector of 3 positive-integer-value integer specifying which 3 pcas will be plot.
labelVariable	The name of a column of the phenotype data matrix. The elements of the column will replace the column names of the expression data matrix.
hybName	character string. indicating the phenotype variable <code>Hybridization_Name</code> .

outFileName	Name of the figure file to be created.
title	Title of the scatter plot.
plotOutPutFlag	logical. plotOutPutFlag=TRUE indicates the plots will be output to pdf format files. Otherwise, the plots will not be output to external files.
mar	A numerical vector of the form 'c(bottom, left, top, right)' which gives the number of lines of margin to be specified on the four sides of the plot. The default is 'c(5, 4, 4, 2) + 0.1'. see <a href="#">par</a> .
lwd	The line width, a <u>positive</u> number, defaulting to '1'. see <a href="#">par</a> .
equalRange	logical. Indicating if the x-axis and y-axis have the same range.
xlab	Label of x axis.
ylab	Label of y axis.
zlab	Label of z axis.
xlim	Range of x axis.
ylim	Range of y axis.
zlim	Range of z axis.
cex.legend	Font size for legend.
cex	numerical value giving the amount by which plotting text and symbols should be magnified relative to the default. see <a href="#">par</a> .
cex.lab	The magnification to be used for x and y labels relative to the current setting of cex.
cex.axis	The magnification to be used for axis annotation relative to the current setting of cex. see <a href="#">par</a> .
legendPosition	Position of legend. Possible values are "bottomright", "bottom", "bottomleft", "left", "topleft", "top", "topright", "right" and "center".
...	Arguments to be passed to <a href="#">plot</a> .

**Value**

A matrix of PCA scores. Each column corresponds to a principal component.

**Author(s)**

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**Examples**

```
# generate simulated data set from conditional normal distribution
set.seed(1234567)
es.sim = genSimData.BayesNormal(nCpGs = 100,
  nCases = 20, nControls = 20,
  mu.n = -2, mu.c = 2,
```

```
    d0 = 20, s02 = 0.64, s02.c = 1.5, testPara = "var",
    outlierFlag = FALSE,
    eps = 1.0e-3, applier = lapply)
print(es.sim)

pca.obj = getPcaFunc(es = es.sim,
                    labelVariable = "subjID",
                    hybName = "memSubj",
                    requireLog2 = FALSE,
                    corFlag = FALSE
)

pca3DPlot(pcaObj = pca.obj,
          plot.dim = c(1,2,3),
          labelVariable = "subjID",
          hybName = "memSubj",
          plotOutPutFlag = FALSE,
          cex.legend = 0.5,
          legendPosition = "topright")
```

---

plotCurves

*Plot trajectories of probe profiles across arrays*

---

## Description

Plot trajectories of probe profiles across arrays

## Usage

```
plotCurves(
  dat,
  curveNames,
  fileName,
  plotOutPutFlag=FALSE,
  requireLog2 = FALSE,
  cex = 1,
  ylim = NULL,
  xlab = "",
  ylab = "intensity",
  lwd = 3,
  main = "Trajectory plot",
  mar = c(10, 4, 4, 2) + 0.1,
  las = 2,
  cex.axis=1,
  ...)
```

**Arguments**

dat	Numeric data matrix. Rows are probes; columns are arrays.
curveNames	Probe names.
fileName	file name of output figure.
plotOutPutFlag	logical. plotOutPutFlag=TRUE indicates the plots will be output to pdf format files. Otherwise, the plots will not be output to external files.
requireLog2	logical. requiredLog2=TRUE indicates probe expression levels will be log2 transformed. Otherwise, no transformation will be performed.
cex	numerical value giving the amount by which plotting text and symbols should be magnified relative to the default. see <a href="#">par</a> .
ylim	Range of y axis.
xlab	Label of x axis.
ylab	Label of y axis.
lwd	The line width, a <code>_positive_</code> number, defaulting to '1'. see <a href="#">par</a> .
main	Main title of the plot.
mar	A numerical vector of the form 'c(bottom, left, top, right)' which gives the number of lines of margin to be specified on the four sides of the plot. The default is 'c(5, 4, 4, 2) + 0.1'. see <a href="#">par</a> .
las	'las' numeric in 0,1,2,3; the style of axis labels. 0 - always parallel to the axis, 1 - always horizontal, 2 - always perpendicular to the axis, or 3 - always vertical. see <a href="#">par</a> .
cex.axis	The magnification to be used for axis annotation relative to the current setting of cex. see <a href="#">par</a> .
...	Arguments to be passed to <a href="#">plot</a> .

**Value**

no return value.

**Author(s)**

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**Examples**

```
# generate simulated data set from conditional normal distribution
set.seed(1234567)
es.sim = genSimData.BayesNormal(nCpGs = 100,
  nCases = 20, nControls = 20,
  mu.n = -2, mu.c = 2,
  d0 = 20, s02 = 0.64, s02.c = 1.5, testPara = "var",
```

```

    outlierFlag = FALSE,
    eps = 1.0e-3, applier = lapply)
print(es.sim)

# plot trajectories of the first 5 genes
plotCurves(
  dat = exprs(es.sim)[1:5,],
  curveNames = featureNames(es.sim)[1:5],
  plotOutPutFlag=FALSE,
  cex = 0.5,
  requireLog2 = FALSE)

```

---

plotQCCurves	<i>Plot trajectories of specific QC probes (e.g., biotin, cy3_hyb, housekeeping gene probes, low stringency probes, etc.) across arrays</i>
--------------	---

---

## Description

Plot trajectories of specific QC probes (e.g., biotin, cy3\_hyb, housekeeping gene probes, low stringency probes, etc.) across arrays

## Usage

```

plotQCCurves(
  esQC,
  probes = c("biotin", "cy3_hyb", "housekeeping",
    "low_stringency_hyb", "signal", "p95p05"),
  labelVariable = "subjID",
  hybName = "Hybridization_Name",
  reporterGroupName = "Reporter_Group_Name",
  requireLog2 = TRUE,
  projectName = "test",
  plotOutPutFlag = FALSE,
  cex = 1,
  ylim = NULL,
  xlab = "",
  ylab = "intensity",
  lwd = 3,
  mar = c(10, 4, 4, 2) + 0.1,
  las = 2,
  cex.axis = 1,
  sortFlag = TRUE,
  varSort = c("Batch_Run_Date", "Chip_Barcode", "Chip_Address"),
  timeFormat = c("%m/%d/%Y", NA, NA),
  ...)

```

**Arguments**

esQC	ExpressionSet object of QC probe profiles. <code>fData(esQC)</code> should contains the variable <code>Reporter_Group_Name</code> .
probes	A character vectors of QC probe names. By default, it includes the following probe names “biotin”, “cy3_hyb”, “housekeeping”, “low_stringency_hyb”, “signal”, “p95p05”. For “signal”, trajectories of 5th, 25th, 50th, 75th, and 95th percentiles of the expression levels of all QC probes will be plotted. For “p95p05”, the trajectory of the ratio of 95th percentile to 5th percentile of the expression levels of all QC probes will be plotted.
labelVariable	A character string. The name of a phenotype data variable use to label the arrays in the boxplots. By default, <code>labelVariable = "subjID"</code> which is equivalent to <code>labelVariable = "Hybridization_Name"</code> .
hybName	character string. indicating the phenotype variable <code>Hybridization_Name</code> .
reporterGroupName	character string. indicating feature variable <code>Reporter_Group_Name</code> (QC probe's name).
requireLog2	logical. <code>requiredLog2=TRUE</code> indicates probe expression levels will be log2 transformed. Otherwise, no transformation will be performed.
projectName	A character string. Name of the project. The plots will be saved as pdf format files, the names of which have the format <code>projectName_probeName_traj_plot.pdf</code> .
plotOutPutFlag	logical. <code>plotOutPutFlag=TRUE</code> indicates the plots will be output to pdf format files. Otherwise, the plots will not be output to external files.
cex	numerical value giving the amount by which plotting text and symbols should be magnified relative to the default. see <a href="#">par</a> .
ylim	Range of y axis.
xlab	Label of x axis.
ylab	Label of y axis.
lwd	The line width, a <code>_positive_</code> number, defaulting to '1'. see <a href="#">par</a> .
mar	A numerical vector of the form 'c(bottom, left, top, right)' which gives the number of lines of margin to be specified on the four sides of the plot. The default is 'c(5, 4, 4, 2) + 0.1'. see <a href="#">par</a> .
las	'las' numeric in 0,1,2,3; the style of axis labels. 0 - always parallel to the axis, 1 - always horizontal, 2 - always perpendicular to the axis, or 3 - always vertical. see <a href="#">par</a> .
cex.axis	The magnification to be used for axis annotation relative to the current setting of <code>cex</code> . see <a href="#">par</a> .
sortFlag	logical. Indicates if arrays need to be sorted according to <code>Batch_Run_Date</code> , <code>Chip_Barcode</code> , and <code>Chip_Address</code> .
varSort	A vector of phenotype variable names to be used to sort the samples of <code>es</code> .
timeFormat	A vector of time format for the possible time variables in <code>varSort</code> . The length of <code>timeFormat</code> should be the same as that of <code>varSort</code> . For non-time variable, the corresponding time format should be set to be equal to <code>NA</code> .
...	Arguments to be passed to <a href="#">plot</a> .

**Value**

no return value.

**Author(s)**

Weiliang Qiu <stwxq@channing.harvard.edu>, Brandon Guo <brandowonder@gmail.com>, Christopher Anderson <christopheranderson84@gmail.com>, Barbara Klanderma <BKLANDERMAN@partners.org>, Vincent Carey <stvjc@channing.harvard.edu>, Benjamin Raby <rebar@channing.harvard.edu>

**Examples**

```
# generate simulated data set from conditional normal distribution
set.seed(1234567)
esQC.sim = genSimData.BayesNormal(nCpGs = 10,
  nCases = 20, nControls = 20,
  mu.n = -2, mu.c = 2,
  d0 = 20, s02 = 0.64, s02.c = 1.5, testPara = "var",
  outlierFlag = FALSE,
  eps = 1.0e-3, applier = lapply)

print(esQC.sim)

fDat = fData(esQC.sim)
esQC.sim$Hybridization_Name = sampleNames(esQC.sim)
fDat$Reporter_Group_Name = c( rep("biotin", 5),
  rep("housekeeping", 5))
fData(esQC.sim)=fDat

# plot trajectories of the QC probes
plotQCCurves(
  esQC = esQC.sim,
  probes = c("biotin", "housekeeping"),
  labelVariable = "subjID",
  hybName = "Hybridization_Name",
  reporterGroupName = "Reporter_Group_Name",
  requireLog2 = FALSE,
  plotOutPutFlag = FALSE,
  sortFlag = FALSE)
```

---

plotSample95p05

*Plot trajectories of the ratio of 95th percentile to 5th percentile of sample probe profiles across arrays*

---

**Description**

Plot trajectories of the ratio of 95th percentile to 5th percentile of sample probe profiles across arrays.

**Usage**

```

plotSamplep95p05(
  es,
  labelVariable = "subjID",
  hybName = "Hybridization_Name",
  requireLog2 = FALSE,
  projectName = "test",
  plotOutPutFlag = FALSE,
  cex = 1,
  ylim = NULL,
  xlab = "",
  ylab = "",
  lwd = 1.5,
  mar = c(10, 4, 4, 2) + 0.1,
  las = 2,
  cex.axis=1.5,
  title = "Trajectory of p95/p05",
  cex.legend = 1.5,
  cex.lab = 1.5,
  legendPosition = "topright",
  cut1 = 10,
  cut2 = 6,
  sortFlag = TRUE,
  varSort = c("Batch_Run_Date", "Chip_Barcode", "Chip_Address"),
  timeFormat = c("%m/%d/%Y", NA, NA),
  verbose = FALSE,
  ...)

```

**Arguments**

<code>es</code>	ExpressionSet object of Sample probe profiles.
<code>labelVariable</code>	A character string. The name of a phenotype data variable use to label the arrays in the boxplots. By default, <code>labelVariable = "subjID"</code> which is equivalent to <code>labelVariable = "Hybridization_Name"</code> .
<code>hybName</code>	character string. indicating the phenotype variable <code>Hybridization_Name</code> .
<code>requireLog2</code>	logical. <code>requiredLog2=TRUE</code> indicates probe expression levels will be log2 transformed. Otherwise, no transformation will be performed.
<code>projectName</code>	A character string. Name of the project. The plots will be saved as pdf format files, the names of which have the format <code>projectName_probeName_traj_plot.pdf</code> .
<code>plotOutPutFlag</code>	logical. <code>plotOutPutFlag=TRUE</code> indicates the plots will be output to pdf format files. Otherwise, the plots will not be output to external files.
<code>cex</code>	numerical value giving the amount by which plotting text and symbols should be magnified relative to the default. see <a href="#">par</a> .
<code>ylim</code>	Range of y axis.
<code>xlab</code>	Label of x axis.
<code>ylab</code>	Label of y axis.

lwd	The line width, a <code>_positive_</code> number, defaulting to '1'. see <a href="#">par</a> .
mar	A numerical vector of the form 'c(bottom, left, top, right)' which gives the number of lines of margin to be specified on the four sides of the plot. The default is 'c(5, 4, 4, 2) + 0.1'. see <a href="#">par</a> .
las	'las' numeric in 0,1,2,3; the style of axis labels. 0 - always parallel to the axis, 1 - always horizontal, 2 - always perpendicular to the axis, or 3 - always vertical. see <a href="#">par</a> .
cex.axis	The magnification to be used for axis annotation relative to the current setting of cex. see <a href="#">par</a> .
title	Figure title.
cex.legend	Font size of legend text.
cex.lab	The magnification to be used for x and y labels relative to the current setting of cex.
legendPosition	Position of legend. Possible values are "bottomright", "bottom", "bottomleft", "left", "topleft", "top", "topright", "right" and "center".
cut1	second horizontal line setting the cutoff for the ratio p95/p05. A ratio above this line indicates the corresponding array is good.
cut2	second horizontal line setting the cutoff for the ratio p95/p05. A ratio below this line indicates the corresponding array is bad.
sortFlag	logical. Indicates if arrays need to be sorted according to Batch_Run_Date, Chip_Barcode, and Chip_Address.
varSort	A vector of phenotype variable names to be used to sort the samples of es.
timeFormat	A vector of time format for the possible time variables in varSort. The length of timeFormat should be the same as that of varSort. For non-time variable, the corresponding time format should be set to be equal to NA. The details of the time format for time variable can be found in the R function <a href="#">strptime</a> .
verbose	logical. Determine if intermediate output need to be suppressed. By default verbose=FALSE, intermediate output will not be printed.
...	Arguments to be passed to <a href="#">plot</a> .

### Details

The trajectory of the ratio of 95 to 5

### Value

A list of 2 elements. The first element is the 2 x n matrix, where n is the number of arrays. The first row of the matrix is the 5-th percentile and the second row of the matrix is the 95-th percentile.

The second element is the ratio of the 95-th percentile to the 5-th percentile.

### Author(s)

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**Examples**

```
# generate simulated data set from conditional normal distribution
set.seed(1234567)
es.sim = genSimData.BayesNormal(nCpGs = 100,
  nCases = 20, nControls = 20,
  mu.n = -2, mu.c = 2,
  d0 = 20, s02 = 0.64, s02.c = 1.5, testPara = "var",
  outlierFlag = FALSE,
  eps = 1.0e-3, applier = lapply)
print(es.sim)

es.sim$Batch_Run_Date = 1:ncol(es.sim)
es.sim$Chip_Barcode = 1:ncol(es.sim)
es.sim$Chip_Address = 1:ncol(es.sim)

plotSamplep95p05(
  es = es.sim,
  labelVariable = "subjID",
  hybName = "memSubj",
  requireLog2 = FALSE,
  projectName = "test",
  plotOutPutFlag = FALSE,
  title = "Trajectory of p95/p05",
  cex.legend = 0.5,
  legendPosition = "topright",
  sortFlag = TRUE,
  varSort = c("Batch_Run_Date", "Chip_Barcode", "Chip_Address"),
  timeFormat = c("%m/%d/%Y", NA, NA),
  verbose = FALSE)
```

---

 quantilePlot

*Plot trajectories of quantiles across arrays*


---

**Description**

Plot trajectories of quantiles across arrays.

**Usage**

```
quantilePlot(
  dat,
  fileName,
  probs = c(0, 0.05, 0.25, 0.5, 0.75, 0.95, 1),
  plotOutPutFlag = FALSE,
  requireLog2 = FALSE,
  sortFlag = TRUE,
  cex = 1,
```

```

ylim = NULL,
xlab = "",
ylab = "intensity",
lwd = 3,
main = "Trajectory plot of quantiles",
mar = c(15, 4, 4, 2) + 0.1,
las = 2,
cex.axis = 1,
...)
```

### Arguments

dat	Expression data. Rows are gene probes; columns are arrays.
fileName	File name of output figure.
probs	quantiles (any real values between the interval [0, 1]).
plotOutPutFlag	logical. plotOutPutFlag=TRUE indicates the plots will be output to pdf format files. Otherwise, the plots will not be output to external files.
requireLog2	logical. requiredLog2=TRUE indicates probe expression levels will be log2 transformed. Otherwise, no transformation will be performed.
sortFlag	logical. sortFlag=TRUE indicates arrays will be sorted by the ascending order of MAD (median absolute deviation)
cex	numerical value giving the amount by which plotting text and symbols should be magnified relative to the default. see <a href="#">par</a> .
ylim	Range of y axis.
xlab	Label of x axis.
ylab	Label of y axis.
lwd	The line width, a <code>_positive_</code> number, defaulting to '1'. see <a href="#">par</a> .
main	Charater string. main title of the plot.
mar	A numerical vector of the form 'c(bottom, left, top, right)' which gives the number of lines of margin to be specified on the four sides of the plot. The default is 'c(5, 4, 4, 2) + 0.1'. see <a href="#">par</a> .
las	'las' numeric in 0,1,2,3; the style of axis labels. 0 - always parallel to the axis, 1 - always horizontal, 2 - always perpendicular to the axis, or 3 - always vertical. see <a href="#">par</a> .
cex.axis	The magnification to be used for axis annotation relative to the current setting of cex. see <a href="#">par</a> .
...	Arguments to be passed to <a href="#">plot</a> .

### Value

The quantile matrix with row quantiles and column array.

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**Examples**

```
# generate simulated data set from conditional normal distribution
set.seed(1234567)
es.sim = genSimData.BayesNormal(nCpGs = 100,
  nCases = 20, nControls = 20,
  mu.n = -2, mu.c = 2,
  d0 = 20, s02 = 0.64, s02.c = 1.5, testPara = "var",
  outlierFlag = FALSE,
  eps = 1.0e-3, applier = lapply)
print(es.sim)

png(file="qplot.png")
quantilePlot(
  dat = exprs(es.sim),
  probs = c(0, 0.05, 0.25, 0.5, 0.75, 0.95, 1),
  plotOutPutFlag = FALSE,
  requireLog2 = FALSE,
  sortFlag = TRUE)
dev.off()
```

---

R2PlotFunc

*Draw heatmap of square of correlations among arrays*


---

**Description**

Draw heatmap of square of correlations among arrays.

**Usage**

```
R2PlotFunc(
  es,
  hybName = "Hybridization_Name",
  arrayType = c("all", "replicates", "GC"),
  GCid = c("128115", "Hela", "Brain"),
  probs = seq(0, 1, 0.25),
  col = gplots::greenred(75),
  labelVariable = "subjID",
  outFileName = "test_R2_raw.pdf",
  title = "Raw Data R^2 Plot",
  requireLog2 = FALSE,
```

```

plotOutPutFlag = FALSE,
las = 2,
keysize = 1,
margins = c(10, 10),
sortFlag = TRUE,
varSort=c("Batch_Run_Date", "Chip_Barcode", "Chip_Address"),
timeFormat=c("%m/%d/%Y", NA, NA),
...)

```

### Arguments

es	ExpressionSet object of QC probe profiles.
hybName	character string. indicating the phenotype variable Hybridization_Name.
arrayType	A character string indicating if the correlations are calculated based on all arrays, arrays with replicates, or genetic control arrays.
GCid	A vector of character string. symbols for genetic control samples. The symbols can be more than one.
probs	A vector of probabilities specify the quantiles of correlations to be output.
col	colors used for the image. see the function <a href="#">heatmap.2</a> in R package <code>gplots</code> .
labelVariable	A character string indicating how to label the arrays.
outFileName	A character string. The name of output file.
title	Title of the plot.
requireLog2	logical. <code>requiredLog2=TRUE</code> indicates probe expression levels will be log2 transformed. Otherwise, no transformation will be performed.
plotOutPutFlag	logical. <code>plotOutPutFlag=TRUE</code> indicates the plots will be output to pdf format files. Otherwise, the plots will not be output to external files.
las	'las' numeric in 0,1,2,3; the style of axis labels. 0 - always parallel to the axis, 1 - always horizontal, 2 - always perpendicular to the axis, or 3 - always vertical. see <a href="#">par</a> .
keysize	numeric value indicating the size of the key. see the function <a href="#">heatmap.2</a> in R package <code>gplots</code> .
margins	numeric vector of length 2 containing the margins. see the function <a href="#">heatmap.2</a> in R package <code>gplots</code> .
sortFlag	logical. Indicates if arrays need to be sorted according to <code>Batch_Run_Date</code> , <code>Chip_Barcode</code> , and <code>Chip_Address</code> .
varSort	A vector of phenotype variable names to be used to sort the samples of es.
timeFormat	A vector of time format for the possible time variables in <code>varSort</code> . The length of <code>timeFormat</code> should be the same as that of <code>varSort</code> . For non-time variable, the corresponding time format should be set to be equal to NA. The details of the time format for time variable can be found in the R function <a href="#">strptime</a> .
...	Arguments to be passed to <a href="#">heatmap.2</a> .

**Value**

A list with 3 elements. The first element `R2Mat` is the matrix of squared correlation. The second element `R2vec` is the vector of the upper triangle of the matrix of squared correlation (diagonal elements are excluded). The third element `R2vec.within.rep` is the vector of within-replicate  $R^2$ , that is, any element in `R2vec.within.rep` is the squared correlation coefficient between two arrays/replicates for a subject.

**Author(s)**

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**Examples**

```
# generate simulated data set from conditional normal distribution
set.seed(1234567)
es.sim = genSimData.BayesNormal(nCpGs = 100,
  nCases = 20, nControls = 20,
  mu.n = -2, mu.c = 2,
  d0 = 20, s02 = 0.64, s02.c = 1.5, testPara = "var",
  outlierFlag = FALSE,
  eps = 1.0e-3, applicer = lapply)
print(es.sim)

es.sim$Batch_Run_Date = 1:ncol(es.sim)
es.sim$Chip_Barcode = 1:ncol(es.sim)
es.sim$Chip_Address = 1:ncol(es.sim)

# draw heatmap for the first 5 subjects
png(file="r2plot.png")
R2PlotFunc(
  es = es.sim[, 1:5],
  hybName = "memSubj",
  arrayType = c("all", "replicates", "GC"),
  GCid = c("128115", "Hela", "Brain"),
  probs = seq(0, 1, 0.25),
  col = gplots::greenred(75),
  labelVariable = "subjID",
  outFileName = "test_R2_raw.pdf",
  title = "Raw Data R^2 Plot",
  requireLog2 = FALSE,
  plotOutPutFlag = FALSE,
  las = 2,
  keysize = 1,
  margins = c(10, 10),
  sortFlag = TRUE,
  varSort=c("Batch_Run_Date", "Chip_Barcode", "Chip_Address"),
  timeFormat=c("%m/%d/%Y", NA, NA))
dev.off()
```

---

sortExpressionSet	<i>Sort the order of samples for an ExpressionSet object</i>
-------------------	--

---

## Description

Sort the order of samples for an ExpressionSet object.

## Usage

```
sortExpressionSet(  
  es,  
  varSort = c("Batch_Run_Date", "Chip_Barcode", "Chip_Address"),  
  timeFormat = c("%m/%d/%Y", NA, NA)  
)
```

## Arguments

es	An ExpressionSet.
varSort	A vector of phenotype variable names to be used to sort the samples of es.
timeFormat	A vector of time format for the possible time variables in varSort. The length of timeFormat should be the same as that of varSort. For non-time variable, the corresponding time format should be set to be equal to NA. Please refer to function <a href="#">strptime</a> of the base package.

## Value

An ExpressionSet object with samples sorted based on the variables indicated in varSort.

## Author(s)

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## Examples

```
# generate simulated data set from conditional normal distribution  
set.seed(1234567)  
es.sim = genSimData.BayesNormal(nCpGs = 100,  
  nCases = 20, nControls = 20,  
  mu.n = -2, mu.c = 2,  
  d0 = 20, s02 = 0.64, s02.c = 1.5, testPara = "var",  
  outlierFlag = FALSE,  
  eps = 1.0e-3, applier = lapply)  
print(es.sim)  
  
es.sim$Batch_Run_Date = 1:ncol(es.sim)  
es.sim$Chip_Barcode = 1:ncol(es.sim)
```

```
es.sim$Chip_Address = 1:ncol(es.sim)
```

```
es.sim2 = sortExpressionSet(  
  es = es.sim,  
  varSort = c("Batch_Run_Date", "Chip_Barcode", "Chip_Address"),  
  timeFormat = c("%m/%d/%Y", NA, NA)  
)
```

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