

# Package ‘selectKSigs’

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**Type** Package

**Title** Selecting the number of mutational signatures using a perplexity-based measure and cross-validation

**Depends** R(>= 3.6)

**Imports** HiLDA, magrittr, gtools, methods, Rcpp

**Suggests** knitr, rmarkdown, testthat, BiocStyle, ggplot2, dplyr, tidyr

**Version** 1.23.0

**Date** 2021-10-18

**Description** A package to suggest the number of mutational signatures in a collection of somatic mutations using calculating the cross-validated perplexity score.

**URL** <https://github.com/USCbiostats/selectKSigs>

**BugReports** <https://github.com/USCbiostats/HiLDA/selectKSigs>

**License** GPL-3

**biocViews** Software, SomaticMutation, Sequencing, StatisticalMethod, Clustering

**RoxygenNote** 7.1.2

**LinkingTo** Rcpp

**VignetteBuilder** knitr

**Encoding** UTF-8

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|                   |   |
|-------------------|---|
| calcPMSLikelihood | <i>A function for calculating the log-likelihood from the data and parameters</i> |
|-------------------|---|

---

### Description

A function for calculating the log-likelihood from the data and parameters

### Usage

```
calcPMSLikelihood(p, y)
```

### Arguments

|   |  |
|---|--|
| p | this variable includes the parameters for mutation signatures and membership parameters                                |
| y | this variable includes the information on the mutation features, the number of mutation signatures specified and so on |

### Value

a value

---

Calculate\_Likelihood\_test

*Output the maximum potential scale reduction statistic of all parameters estimated*

---

### Description

Output the maximum potential scale reduction statistic of all parameters estimated

### Usage

```
Calculate_Likelihood_test(train, test, paramG)
```

### Arguments

|        |   |
|--------|---|
| train  | a MutationFeatureData S4 class output of training data.   |
| test   | a MutationFeatureData S4 class output of test data.       |
| paramG | an estimatedParameters S4 class with estimated parameters |

### Value

the likelihood of the test data

---

convertFromTurbo\_F *Restore the converted parameter F for turboEM*

---

### Description

Restore the converted parameter F for turboEM

### Usage

```
convertFromTurbo_F(turboF, fdim, signatureNum, isBackground)
```

### Arguments

|              |   |
|--------------|---|
| turboF       | F (converted for turboEM)   |
| fdim         | a vector specifying the number of possible values for each mutation signature       |
| signatureNum | the number of mutation signatures   |
| isBackground | the logical value showing whether a background mutaiton features is included or not |

### Value

a vector

---

convertFromTurbo\_Q     *Restore the converted parameter Q for turboEM*

---

### Description

Restore the converted parameter Q for turboEM

### Usage

```
convertFromTurbo_Q(turboQ, signatureNum, sampleNum)
```

### Arguments

|              |                                   |
|--------------|-----------------------------------|
| turboQ       | Q (converted for turboEM)         |
| signatureNum | the number of mutation signatures |
| sampleNum    | the number of cancer genomes      |

### Value

a vector

---

convertToTurbo\_F     *Convert the parameter F so that turboEM can treat*

---

### Description

Convert the parameter F so that turboEM can treat

### Usage

```
convertToTurbo_F(vF, fdim, signatureNum, isBackground)
```

### Arguments

|              |   |
|--------------|---|
| vF           | F (converted to a vector)   |
| fdim         | a vector specifying the number of possible values for each mutation signature       |
| signatureNum | the number of mutation signatures   |
| isBackground | the logical value showing whether a background mutation features is included or not |

### Value

a vector

---

|                  |  |
|------------------|--|
| convertToTurbo_Q | <i>Convert the parameter Q so that turboEM can treat</i> |
|------------------|--|

---

**Description**

Convert the parameter Q so that turboEM can treat

**Usage**

```
convertToTurbo_Q(vQ, signatureNum, sampleNum)
```

**Arguments**

|              |                                   |
|--------------|-----------------------------------|
| vQ           | Q (converted to a vector)         |
| signatureNum | the number of mutation signatures |
| sampleNum    | the number of cancer genomes      |

**Value**

a vector

---

|                |   |
|----------------|---|
| cv_PMSignature | <i>Output the maximum potential scale reduction statistic of all parameters estimated</i> |
|----------------|---|

---

**Description**

Output the maximum potential scale reduction statistic of all parameters estimated

**Usage**

```
cv_PMSignature(inputG, Kfold = 3, nRep = 3, Klimit = 8)
```

**Arguments**

|        |  |
|--------|--|
| inputG | a MutationFeatureData S4 class.                            |
| Kfold  | an integer number of the number of cross-validation folds. |
| nRep   | an integer number of replications.                         |
| Klimit | an integer of the maximum value of number of signatures.   |

**Value**

a matrix of measures

**Examples**

```
load(system.file("extdata/sample.rdata", package = "selectKSigs"))
results <- cv_PMSignature(G, Kfold = 3)
```

---

|       |   |
|-------|---|
| getBG | <i>Get the status of using the background signature</i> |
|-------|---|

---

**Description**

Get the status of using the background signature

**Usage**

```
getBG(object)
```

**Arguments**

object            the EstimatedParameters class (the result of pmgetSignature)

**Value**

the status of using the background signature

---

|           |                                       |
|-----------|---------------------------------------|
| getCounts | <i>Get the count data in a matrix</i> |
|-----------|---------------------------------------|

---

**Description**

Get the count data in a matrix

**Usage**

```
getCounts(object)
```

**Arguments**

object            the MutationFeatureData class

**Value**

the count data in a matrix

---

|              |   |
|--------------|---|
| getExposures | <i>Get a matrix of mutational exposures of signatures</i> |
|--------------|---|

---

**Description**

Get a matrix of mutational exposures of signatures

**Usage**

```
getExposures(object)
```

**Arguments**

object            the EstimatedParameters class (the result of pmgetSignature)

**Value**

a matrix of mutational exposures of signatures

---

|             |  |
|-------------|--|
| getFeatures | <i>Get a vector of possible features</i> |
|-------------|--|

---

**Description**

Get a vector of possible features

**Usage**

```
getFeatures(object)
```

**Arguments**

object            the EstimatedParameters class (the result of pmgetSignature)

**Value**

a vector of possible features

---

|               |  |
|---------------|--|
| getFeatureVec | <i>Get a matrix of feature vector list</i> |
|---------------|--|

---

**Description**

Get a matrix of feature vector list

**Usage**

```
getFeatureVec(object)
```

**Arguments**

object            the MutationFeatureData class

**Value**

a matrix of feature vector list

---

|      |                                     |
|------|-------------------------------------|
| getK | <i>Get the number of signatures</i> |
|------|-------------------------------------|

---

**Description**

Get the number of signatures

**Usage**

```
getK(object)
```

**Arguments**

object            the EstimatedParameters class (the result of pmgetSignature)

**Value**

the number of signatures in pmgetSignature in HiLDA

---

|       |  |
|-------|--|
| getLL | <i>Get the values of loglikelihood</i> |
|-------|--|

---

**Description**

Get the values of loglikelihood

**Usage**

```
getLL(object)
```

**Arguments**

object            the EstimatedParameters class (the result of pmgetSignature)

**Value**

likelihood values estimated by pmgetSignature in HiLDA

---

|                   |   |
|-------------------|---|
| getLogLikelihoodC | <i>Calculate the value of the log-likelihood for given parameters</i> |
|-------------------|---|

---

**Description**

Calculate the value of the log-likelihood for given parameters

**Usage**

```
getLogLikelihoodC(
  vPatternList,
  vSparseCount,
  vF,
  vQ,
  fdim,
  signatureNum,
  sampleNum,
  patternNum,
  samplePatternNum,
  isBackground,
  vF0
)
```

**Arguments**

vPatternList    The list of possible mutation features (converted to a vector)  
vSparseCount    The table showing (mutation feature, sample, the number of mutation) (converted to a vector)  
vF                F (converted to a vector)  
vQ                Q (converted to a vector)

|                  |   |
|------------------|---|
| fdim             | a vector specifying the number of possible values for each mutation signature       |
| signatureNum     | the number of mutation signatures   |
| sampleNum        | the number of cancer genomes  |
| patternNum       | the number of possible combinations of all the mutation features                    |
| samplePatternNum | the number of possible combination of samples and mutation patterns                 |
| isBackground     | the logical value showing whether a background mutation features is included or not |
| vF0              | a background mutation features  |

**Value**

a value

---

|               |                            |
|---------------|----------------------------|
| getSamplelist | <i>Get the sample list</i> |
|---------------|----------------------------|

---

**Description**

Get the sample list

**Usage**

```
getSamplelist(object)
```

**Arguments**

|        |  |
|--------|--|
| object | the EstimatedParameters class (the result of pmgetSignature) |
|--------|--|

**Value**

the sample list of named elements.

---

|                |                            |
|----------------|----------------------------|
| getSamplelistG | <i>Get the sample list</i> |
|----------------|----------------------------|

---

**Description**

Get the sample list

**Usage**

```
getSamplelistG(object)
```

**Arguments**

|        |                               |
|--------|-------------------------------|
| object | the MutationFeatureData class |
|--------|-------------------------------|

**Value**

the sample list of named elements.

---

|               |  |
|---------------|--|
| getSignatures | <i>Get an array of signature feature distributions</i> |
|---------------|--|

---

**Description**

Get an array of signature feature distributions

**Usage**

```
getSignatures(object)
```

**Arguments**

object            the EstimatedParameters class (the result of pmgetSignature)

**Value**

an array of signature feature distributions

---

|                  |  |
|------------------|--|
| getTranscription | <i>Get the status of specifying the transcription bias</i> |
|------------------|--|

---

**Description**

Get the status of specifying the transcription bias

**Usage**

```
getTranscription(object)
```

**Arguments**

object            the MutationFeatureData class

**Value**

the status of specifying the transcription bias

---

|                 |  |
|-----------------|--|
| select_kth_fold | <i>Output the training data or test data</i> |
|-----------------|--|

---

**Description**

Output the training data or test data

**Usage**

```
select_kth_fold(inputG, k, f_s, folds, include)
```

**Arguments**

|         |   |
|---------|---|
| inputG  | a MutationFeatureData S4 class output by the pmsignature.     |
| k       | an integer number of the number of cross-validation folds.    |
| f_s     | a primary key of combining the feature pattern and sample ID. |
| folds   | the assignment to each fold.                                  |
| include | a boolean indicator of whether to include kth fold or not.    |

**Value**

a MutationFeatureData S4 class of either include or exclude kth fold.

---

|        |   |
|--------|---|
| splitG | <i>Output the maximum potential scale reduction statistic of all parameters estimated</i> |
|--------|---|

---

**Description**

Output the maximum potential scale reduction statistic of all parameters estimated

**Usage**

```
splitG(inputG, Kfold = 3)
```

**Arguments**

|        |  |
|--------|--|
| inputG | a MutationFeatureData S4 class output by the pmsignature.  |
| Kfold  | an integer number of the number of cross-validation folds. |

**Value**

a matrix made of perplexity from the results of cross-validation.

**Examples**

```
load(system.file("extdata/sample.rdata", package = "selectKSigs"))
G_split <- splitG(G, Kfold = 3)
```

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