

# Package ‘MesKit’

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**Type** Package

**Title** A tool kit for dissecting cancer evolution from multi-region derived tumor biopsies via somatic alterations

**Version** 1.14.0

**Description** MesKit provides commonly used analysis and visualization modules based on mutational data generated by multi-region sequencing (MRS). This package allows to depict mutational profiles, measure heterogeneity within or between tumors from the same patient, track evolutionary dynamics, as well as characterize mutational patterns on different levels. Shiny application was also developed for a need of GUI-based analysis. As a handy tool, MesKit can facilitate the interpretation of tumor heterogeneity and the understanding of evolutionary relationship between regions in MRS study.

**License** GPL-3

**Encoding** UTF-8

**LazyData** TRUE

**Depends** R (>= 4.0.0)

**Imports** methods, data.table, Biostrings, dplyr, tidyr (>= 1.0.0), ape (>= 5.4.1), ggrepel, pracma, ggridges, AnnotationDbi, IRanges, circlize, cowplot, mclust, phangorn, ComplexHeatmap (>= 1.9.3), ggplot2, RColorBrewer, grDevices, stats, utils, S4Vectors

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**VignetteBuilder** knitr

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calFst	<i>calFst</i>
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---

## Description

Genetic divergence between regions of subclonal sSNVs using the Weir and Cockerham method

## Usage

```
calFst(
  maf,
  patient.id = NULL,
  min.vaf = 0,
  min.total.depth = 2,
  use.adjVAF = FALSE,
  plot = TRUE,
  withinTumor = FALSE,
  use.circle = TRUE,
  title = NULL,
  number.cex = 8,
  number.col = "#C77960",
  use.tumorSampleLabel = FALSE,
  ...
)
```

## Arguments

maf	A Maf or MafList object generated by <a href="#">readMaf</a> function.
patient.id	Select the specific patients. Default NULL, all patients are included.
min.vaf	Specify The minimum VAF to filter variants. Default 0.
min.total.depth	The minimum total allele depth for filtering variants. Default 2.
use.adjVAF	Use adjusted VAF in analysis when adjusted VAF or CCF is available. Default FALSE.
plot	Logical (Default: TRUE).
withinTumor	Logical (Default: FALSE). Whether calculate between-region heterogeneity within tumors.
use.circle	Logical (Default: TRUE). Whether use "circle" in the plot. as visualization method of correlation matrix
title	The title of the plot. Default "Nei's distance"

`number.cex`      The size of text shown in correlation plot. Default 8.  
`number.col`      The color of text shown in correlation plot. Default "#C77960".  
`use.tumorSampleLabel`  
                   Logical (Default: FALSE). Rename the 'Tumor\_Sample\_Barcode' by 'Tumor\_Sample\_Label'.  
`...`              Other options passed to `subMaf`

### Value

A list contains Fst value of MRS and Hudson estimator of each sample-pair, respectively.

### References

Sun R, Hu Z, Sottoriva A, et al. Between-region genetic divergence reflects the mode and tempo of tumor evolution. *Nat Genet.* 2017;49(7):1015-1024.

Bhatia G, Patterson N, Sankararaman S, Price AL. Estimating and interpreting FST: the impact of rare variants. *Genomic Res.* 2013;23(9):1514-1521.

### Examples

```

maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccfFile=ccf.File, refBuild="hg19")
calFst(maf)

```

---

calJSI

*compareJSI*

---

### Description

The Jaccard similarity index (JSI) is applied to distinguish monoclonal versus polyclonal seeding in metastases.

### Usage

```

calJSI(
  maf,
  patient.id = NULL,
  pairByTumor = FALSE,
  min.ccf = 0,
  plot = FALSE,
  use.circle = TRUE,
  title = NULL,
  number.cex = 8,
  number.col = "#C77960",
  use.tumorSampleLabel = FALSE,
  ...
)

```

**Arguments**

maf	Maf or MafList object generated by <a href="#">readMaf</a> function.
patient.id	Select the specific patients. Default NULL, all patients are included.
pairByTumor	Compare JSI between different tumors. Default FALSE.
min.ccf	The minimum value of CCF. Default 0.
plot	Logical (Default: FALSE).
use.circle	Logical (Default: TRUE). Whether to use "circle" as visualization method of correlation matrix.
title	Title of the plot Default "Jaccard similarity".
number.cex	The size of text shown in correlation plot. Default 8.
number.col	The color of text shown in correlation plot. Default "#C77960".
use.tumorSampleLabel	Logical (Default: FALSE). Rename the 'Tumor_Sample_Barcode' by 'Tumor_Sample_Label'.
...	Other options passed to <a href="#">subMaf</a>

**Value**

Correlation matrix and heatmap via Jaccard similarity coefficient method

**References**

Hu, Z., Li, Z., Ma, Z. et al. Multi-cancer analysis of clonality and the timing of systemic spread in paired primary tumors and metastases. Nat Genet (2020).

**Examples**

```
maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccfFile=ccf.File, refBuild="hg19")
calJSI(maf)
```

---

calNeiDist

*calNeiDist*


---

**Description**

Nei's distance of CCF for sample/tumor pair.

**Usage**

```
calNeiDist(
  maf,
  patient.id = NULL,
  withinTumor = FALSE,
  min.ccf = 0,
  plot = TRUE,
  use.circle = TRUE,
  title = NULL,
  number.cex = 8,
  number.col = "#C77960",
  use.tumorSampleLabel = FALSE,
  ...
)
```

**Arguments**

maf	A Maf or MafList object generated by <a href="#">readMaf</a> function.
patient.id	Select the specific patients. Default NULL, all patients are included.
withinTumor	Calculate between-region heterogeneity within tumor. (Default: FALSE).
min.ccf	Specify the minimum CCF. Default 0.
plot	Logical (Default: TRUE).
use.circle	Logical (Default: TRUE). Whether to use "circle" as visualization method of correlation matrix.
title	The title of the plot. Default "Nei's distance"
number.cex	The size of text shown in correlation plot. Default 8.
number.col	The color of text shown in correlation plot. Default "#C77960".
use.tumorSampleLabel	Logical (Default: FALSE). Rename the 'Tumor_Sample_Barcode' by 'Tumor_Sample_Label'.
...	Other options passed to <a href="#">subMaf</a>

**Value**

Nei's genetic distance matrix and heatmap of sample-pairs from the same patient

**References**

Lee JK, Wang J, Sa JK, et al. Spatiotemporal genomic architecture informs precision oncology in glioblastoma. *Nat Genet.* 2017;49(4):594-599.

**Examples**

```
maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccfFile=ccf.File, refBuild="hg19")
calNeiDist(maf)
```

ccfAUC

*ccfAUC***Description**

The tumor heterogeneity was estimated as the area under the curve (AUC) of the cumulative density function from all cancer cell fractions per tumor

**Usage**

```
ccfAUC(
  maf,
  patient.id = NULL,
  min.ccf = 0,
  withinTumor = FALSE,
  plot.density = TRUE,
  use.tumorSampleLabel = FALSE,
  ...
)
```

**Arguments**

<code>maf</code>	A Maf or MafList object generated by <a href="#">readMaf</a> function.
<code>patient.id</code>	Select the specific patients. Default NULL, all patients are included.
<code>min.ccf</code>	The minimum value of CCF. Default 0.
<code>withinTumor</code>	Calculate between-region heterogeneity within tumor. Default FALSE.
<code>plot.density</code>	Whether to show the density plot. Default TRUE.
<code>use.tumorSampleLabel</code>	Logical (Default: FALSE). Rename the 'Tumor_Sample_Barcode' by 'Tumor_Sample_Label'.
<code>...</code>	Other options passed to <a href="#">subMaf</a>

**Value**

A list containing AUC of CCF and a graph

**References**

Charoentong P, Finotello F, et al. Pan-cancer Immunogenomic Analyses Reveal Genotype-Immunophenotype Relationships and Predictors of Response to Checkpoint Blockade. Cell reports 2017, 18:248-262.

**Examples**

```
maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccfFile=ccf.File, refBuild="hg19")
ccfAUC(maf)
```

---

classifyMut	<i>classifyMut</i>
-------------	--------------------

---

**Description**

classifyMut

**Usage**

```
classifyMut(maf, patient.id = NULL, class = "SP", classByTumor = FALSE, ...)
```

**Arguments**

maf	Maf or MafList object generated by <a href="#">readMaf</a> function. Classify SSNVs/Indels into Shared/P-shared/Private, Clonal/Subclonl or Shared-Clonal/P-shared-Clonal/Private-Clonal/Shared-Subclonal/P-shared-SubClonal/Private-SubClonal
patient.id	Select the specific patients. Default NULL, all patients are included
class	The class which would be represented. Default: "SP" (Shared pattern: Public/Shared/Private), other options: "CS" (Clonal status: Clonal/Subclonl) and "SPCS".
classByTumor	Logical (Default: FALSE). Classify mutations based on "Tumor_ID".
...	Other options passed to <a href="#">subMaf</a>

**Value**

A data.frame with classification of mutations for each patient

**Examples**

```
maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccfFile=ccf.File, refBuild="hg19")
classifyMut(maf, class = "SP")
```

---

cna2gene	<i>cna2gene</i>
----------	-----------------

---

**Description**

cna2gene

**Usage**

```
cna2gene(seg, txdb, min.overlap.len = 50, geneList = NULL)
```



**Arguments**

seg	seg object generated by <a href="#">readSegment</a> function.
txdb	A TxDb object. i.e., TxDb.Hsapiens.UCSC.hg19.knownGene. Default NULL.
min.overlap.len	The minimum insertion size of segment and gene. Default 50.
geneList	The list of genes used to limit the annotation. Default NULL.

**Value**

seg object

**Examples**

```
segFile <- system.file("extdata", "CRC_HZ.seg.txt", package = "MesKit")
gisticAmpGenesFile <- system.file("extdata", "COREAD_amp_genes.conf_99.txt", package = "MesKit")
gisticDelGenesFile <- system.file("extdata", "COREAD_del_genes.conf_99.txt", package = "MesKit")
gisticAllLesionsFile <- system.file("extdata", "COREAD_all_lesions.conf_99.txt", package = "MesKit")
seg <- readSegment(segFile = segFile,
                  gisticAmpGenesFile = gisticAmpGenesFile,
                  gisticDelGenesFile = gisticDelGenesFile,
                  gisticAllLesionsFile = gisticAllLesionsFile)

library(TxDb.Hsapiens.UCSC.hg19.knownGene)
library(org.Hs.eg.db)
cna2gene(seg, txdb = TxDb.Hsapiens.UCSC.hg19.knownGene)
```

---

compareCCF

*compareCCF*

---

**Description**

Compare the CCF between samples/tumor pairs This function requires CCF for clustering

**Usage**

```
compareCCF(
  maf,
  patient.id = NULL,
  min.ccf = 0,
  pairByTumor = FALSE,
  use.tumorSampleLabel = FALSE,
  ...
)
```

**Arguments**

maf	Maf or MafList object generated by <a href="#">readMaf</a> function.
patient.id	Select the specific patients. Default NULL, all patients are included.
min.ccf	The minimum value of CCF. Default 0.
pairByTumor	Pair by tumor types in each patients. Default FALSE.
use.tumorSampleLabel	Logical (Default: FALSE). Rename the 'Tumor_Sample_Barcode' by 'Tumor_Sample_Label'.
...	Other options passed to <a href="#">subMaf</a>

**Value**

a result list of CCF comparing between samples/tumor pairs

**Examples**

```
maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccfFile=ccf.File, refBuild="hg19")
compareCCF(maf)
```

---

compareTree

*compareTree*

---

**Description**

Compares two phylogenetic trees and returns a detailed report of several distance methods

**Usage**

```
compareTree(
  phyloTree1,
  phyloTree2,
  plot = FALSE,
  min.ratio = 1/20,
  show.bootstrap = FALSE,
  use.tumorSampleLabel = FALSE
)
```

**Arguments**

phyloTree1	A phyloTree object generated by <a href="#">getPhyloTree</a> function.
phyloTree2	A phyloTree object generated by <a href="#">getPhyloTree</a> function.
plot	Logical (Default: FALSE). If TRUE, two trees will be plotted on the same device and their similarities will be shown.

min.ratio Double, Default 1/20. If min.ratio is not NULL, all edge length which are smaller than min.ratio\*the longest edge length will be reset as min.ratio\*longest edge length.

show.bootstrap Logical (Default: FALSE). Whether to add bootstrap value on internal nodes.

use.tumorSampleLabel Logical (Default: FALSE). Rename the 'Tumor\_Sample\_Barcode' by 'Tumor\_Sample\_Label'.

### Value

A vector containing the following tree distance methods by R package phangorn Symmetric.difference Robinson-Foulds distance KF-branch distance the branch score distance (Kuhner & Felsenstein 1994) Path.difference difference in the path length, counted as the number of branches Weighted.path.difference difference in the path length, counted using branches lengths

### Examples

```
maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccfFile=ccf.File, refBuild="hg19")

phyloTree1 <- getPhyloTree(maf$V402, method = "NJ")
phyloTree2 <- getPhyloTree(maf$V402, method = "MP")
compareTree(phyloTree1, phyloTree2)
compareTree(phyloTree1, phyloTree2, plot = TRUE)
```

---

fitSignatures

*fitSignatures*

---

### Description

Find nonnegative linear combination of mutation signatures to reconstruct matrix and calculate cosine similarity based on somatic SNVs.

### Usage

```
fitSignatures(
  tri_matrix = NULL,
  patient.id = NULL,
  signaturesRef = "cosmic_v2",
  associated = NULL,
  min.mut.count = 15,
  signature.cutoff = 0.1
)
```

**Arguments**

<code>tri_matrix</code>	A matrix or a list of matrix generated by <code>triMatrix</code> function.
<code>patient.id</code>	Select the specific patients. Default NULL, all patients are included
<code>signaturesRef</code>	Signature reference, Users can upload their own reference. Default "cosmic_v2". Option: "exome_cosmic_v3", "nature2013".
<code>associated</code>	Associated Vector of associated signatures. If given, will narrow the signatures reference to only the ones listed. Default NULL.
<code>min.mut.count</code>	The threshold for the variants in a branch. Default 15.
<code>signature.cutoff</code>	Discard any signature relative contributions with a weight less than this amount. Default 0.1.

**Value**

A list of data frames, each one contains treeMSOutput, containing information about each set/branch's mutational signature.

**Examples**

```
maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccfFile=ccf.File, refBuild="hg19")

## Load a reference genome.
library(BSgenome.Hsapiens.UCSC.hg19)

phyloTree <- getPhyloTree(maf, patient.id = 'V402')
tri_matrix <- triMatrix(phyloTree)
fitSignatures(tri_matrix)
```

---

`getBinaryMatrix`      *getBinaryMatrix*

---

**Description**

`getBinaryMatrix`

**Usage**

```
getBinaryMatrix(object)

## S4 method for signature 'phyloTree'
getBinaryMatrix(object)
```

**Arguments**

object            An object of phyloTree

**Value**

Binary matrix of phyloTree

**Examples**

```
maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccfFile=ccf.File, refBuild="hg19")
phyloTree <- getPhyloTree(maf)
getBinaryMatrix(phyloTree$V402)
```

---

getBootstrapValue        *getBootstrapValue*

---

**Description**

getBootstrapValue

**Usage**

```
getBootstrapValue(object)

## S4 method for signature 'phyloTree'
getBootstrapValue(object)
```

**Arguments**

object            An object of phyloTree

**Value**

Bootstrap value of phyloTree

**Examples**

```
maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccfFile=ccf.File, refBuild="hg19")
phyloTree <- getPhyloTree(maf)
getBootstrapValue(phyloTree$V402)
```

---

getBranchType	<i>getBranchType</i>
---------------	----------------------

---

**Description**

getBranchType

**Usage**

```
getBranchType(object)

## S4 method for signature 'phyloTree'
getBranchType(object)
```

**Arguments**

object            An object of phyloTree

**Value**

Branch type of phyloTree

**Examples**

```
maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccfFile=ccf.File, refBuild="hg19")
phyloTree <- getPhyloTree(maf)
getBranchType(phyloTree$V402)
```

---

getCCFMatrix	<i>getCCFMatrix</i>
--------------	---------------------

---

**Description**

getCCFMatrix

**Usage**

```
getCCFMatrix(object)

## S4 method for signature 'phyloTree'
getCCFMatrix(object)
```

**Arguments**

object            An object of phyloTree

**Value**

CCF matrix of phyloTree

**Examples**

```
maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccfFile=ccf.File, refBuild="hg19")
phyloTree <- getPhyloTree(maf)
getCCFMatrix(phyloTree$V402)
```

---

getMafData

*getMafData*

---

**Description**

getMafData

**Usage**

```
getMafData(object)
```

```
## S4 method for signature 'Maf'
getMafData(object)
```

**Arguments**

object            An object of Maf

**Value**

Maf data

**Examples**

```
maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccfFile=ccf.File, refBuild="hg19")
getMafData(maf$V402)
```

---

getMafPatient	<i>getMafPatient</i>
---------------	----------------------

---

**Description**

getMafPatient

**Usage**

```
getMafPatient(object)

## S4 method for signature 'Maf'
getMafPatient(object)
```

**Arguments**

object            An object of Maf

**Value**

Human reference genome versions of Maf

**Examples**

```
maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccfFile=ccf.File, refBuild="hg19")
getMafPatient(maf$V402)
```

---

getMafRef	<i>getMafRef</i>
-----------	------------------

---

**Description**

getMafRef

**Usage**

```
getMafRef(object)

## S4 method for signature 'Maf'
getMafRef(object)
```

**Arguments**

object            An object of Maf



**Value**

Human reference genome versions of Maf

**Examples**

```
maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccfFile=ccf.File, refBuild="hg19")
getMafRef(maf$V402)
```

---

getMutBranches	<i>getMutBranches</i>
----------------	-----------------------

---

**Description**

getMutBranches

**Usage**

```
getMutBranches(object)

## S4 method for signature 'phyloTree'
getMutBranches(object)
```

**Arguments**

object            An object of phyloTree

**Value**

Branches mutation of phyloTree

**Examples**

```
maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccfFile=ccf.File, refBuild="hg19")
phyloTree <- getPhyloTree(maf)
getMutBranches(phyloTree$V402)
```

---

getNonSyn_vc	<i>getNonSyn_vc</i>
--------------	---------------------

---

**Description**

getNonSyn\_vc

**Usage**

```
getNonSyn_vc(object)

## S4 method for signature 'Maf'
getNonSyn_vc(object)
```

**Arguments**

object            An object of Maf

**Value**

A list of Variant classifications which are considered as non-silent.

**Examples**

```
maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccfFile=ccf.File, refBuild="hg19")
getNonSyn_vc(maf$V402)
```

---

getPhyloTree	<i>getPhyloTree</i>
--------------	---------------------

---

**Description**

getPhyloTree

**Usage**

```
getPhyloTree(
  maf,
  patient.id = NULL,
  method = "NJ",
  min.vaf = 0,
  min.ccf = 0,
  bootstrap.rep.num = 100,
  ...
)
```

**Arguments**

maf	Maf or MafList object generated by <a href="#">readMaf</a> function
patient.id	Select the specific patients. Default NULL, all patients are included.
method	Approach to construct phylogenetic trees. Choose one of "NJ"(Neibor-Joining), "MP"(maximum parsimony), "ML"(maximum likelihood), "FASTME.ols" or "FASTME.bal".
min.vaf	The minimum value of vaf. Default 0.
min.ccf	The minimum value of CCF. Default 0
bootstrap.rep.num	Bootstrap iterations. Default 100.
...	Other options passed to <a href="#">subMaf</a>

**Value**

PhyloTree or phyloTreeList object

**Examples**

```
maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccfFile=ccf.File, refBuild="hg19")
phyloTree <- getPhyloTree(maf)
```

---

getPhyloTreePatient    *getPhyloTreePatient*

---

**Description**

getPhyloTreePatient

**Usage**

```
getPhyloTreePatient(object)

## S4 method for signature 'phyloTree'
getPhyloTreePatient(object)
```

**Arguments**

object            An object of phyloTree

**Value**

patientID of phyloTree

## Examples

```
maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccfFile=ccf.File, refBuild="hg19")
phyloTree <- getPhyloTree(maf)
getPhyloTreePatient(phyloTree$V402)
```

---

getPhyloTreeRef	<i>getPhyloTreeRef</i>
-----------------	------------------------

---

## Description

getPhyloTreeRef

## Usage

```
getPhyloTreeRef(object)

## S4 method for signature 'phyloTree'
getPhyloTreeRef(object)

## S4 method for signature 'phyloTree'
getPhyloTreeTsbLabel(object)
```

## Arguments

object            An object of phyloTree

## Value

Reference genome versions of phyloTree

## Examples

```
maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccfFile=ccf.File, refBuild="hg19")
phyloTree <- getPhyloTree(maf)
getPhyloTreeRef(phyloTree$V402)
```

---

getPhyloTreeTsbLabel    *getPhyloTreeRef*

---

**Description**

getPhyloTreeRef

**Usage**

```
getPhyloTreeTsbLabel(object)
```

**Arguments**

object                    An object of phyloTree

**Value**

relationship between Tumor\_Sample\_Barcode and Tumor\_Sample\_Label

**Examples**

```
maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccfFile=ccf.File, refBuild="hg19")
phyloTree <- getPhyloTree(maf)
getPhyloTreeTsbLabel(phyloTree$V402)
```

---

getSampleInfo            *getSampleInfo*

---

**Description**

getSampleInfo

**Usage**

```
getSampleInfo(object)
```

```
## S4 method for signature 'Maf'
getSampleInfo(object)
```

**Arguments**

object                    An object of Maf

**Value**

Sample information

**Examples**

```
maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccfFile=ccf.File, refBuild="hg19")
getSampleInfo(maf$V402)
```

---

getTree

*getTree*

---

**Description**

getTree

**Usage**

```
getTree(object)
```

```
## S4 method for signature 'phyloTree'
getTree(object)
```

**Arguments**

object            An object of phyloTree

**Value**

Tree object of phyloTree

**Examples**

```
maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccfFile=ccf.File, refBuild="hg19")
phyloTree <- getPhyloTree(maf)
getTree(phyloTree$V402)
```

---

getTreeMethod	<i>getTreeMethod</i>
---------------	----------------------

---

**Description**

getTreeMethod

**Usage**

```
getTreeMethod(object)

## S4 method for signature 'phyloTree'
getTreeMethod(object)
```

**Arguments**

object            An object of phyloTree

**Value**

Tree construction method of phyloTree

**Examples**

```
maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccfFile=ccf.File, refBuild="hg19")
phyloTree <- getPhyloTree(maf)
getTreeMethod(phyloTree$V402)
```

---

Maf-class	<i>Maf class</i>
-----------	------------------

---

**Description**

Maf class.

**Slots**

data   data.table of MAF file containing somatic mutations.  
sample.info   data.frame of sample information per patient.  
nonSyn.vc   list of variant classifications which are considered as non-silent. Default NULL, use Variant Classifications with "Frame\_Shift\_Del", "Frame\_Shift\_Ins", "Splice\_Site", "Translation\_Start\_Site", "Nonsense\_Mutation", "Nonstop\_Mutation", "In\_Frame\_Del", "In\_Frame\_Ins", "Missense\_Mutation"  
ref.build   human reference genome version. Default 'hg19'. Optional: 'hg18' or 'hg38'.

---

MafList-class	<i>MafList class</i>
---------------	----------------------

---

**Description**

S4 class for storing a list of Maf objects.

**Slots**

.Data a list of [Maf](#) objects.

**Constructor**

`MafList(...)` combine multiple Maf objects supplied in ... into a MafList object.

---

mathScore	<i>mathScore</i>
-----------	------------------

---

**Description**

calculates MATH score of each tumor sample or based on Mutant-Allele Tumor Heterogeneity (MATH) approach.

**Usage**

```
mathScore(
  maf,
  patient.id = NULL,
  withinTumor = FALSE,
  min.vaf = 0,
  use.adjVAF = FALSE,
  segFile = NULL,
  use.tumorSampleLabel = FALSE,
  ...
)
```

**Arguments**

<code>maf</code>	Maf or MafList object generated by <a href="#">readMaf</a> function.
<code>patient.id</code>	Select the specific patients. Default NULL, all patients are included.
<code>withinTumor</code>	Calculate between-region heterogeneity within tumor. Default: FALSE.
<code>min.vaf</code>	Specify The minimum VAF to filter variants. Default: 0.
<code>use.adjVAF</code>	Use adjusted VAF in analysis when adjusted VAF or CCF is available. Default: FALSE.



segFile            The segment file.  
 use.tumorSampleLabel            Logical (Default: FALSE). Rename the 'Tumor\_Sample\_Barcode' by 'Tumor\_Sample\_Label'.  
 ...                Other options passed to [subMaf](#)

### Value

A data.frame of MATH scores

### References

Mroz, Edmund A. et al. Intra-Tumor Genetic Heterogeneity and Mortality in Head and Neck Cancer: Analysis of Data from The Cancer Genome Atlas. Ed. Andrew H. Beck. PLoS Medicine 12.2 (2015): e1001786.

### Examples

```

maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccfFile=ccf.File, refBuild="hg19")
mathScore(maf)

```

---

mutCluster

*mutCluster*

---

### Description

Cluster mutations based on variant allele frequencies (VAFs) or cancer cell fractions (CCFs).

### Usage

```

mutCluster(
  maf,
  patient.id = NULL,
  use.ccf = FALSE,
  segFile = NULL,
  withinTumor = FALSE,
  use.tumorSampleLabel = FALSE,
  ...
)

```

**Arguments**

maf	Maf or MafList object generated by <a href="#">readMaf</a> function.
patient.id	Select the specific patients. Default NULL, all patients are included.
use.ccf	Cluster CCF. Default FALSE.
segFile	The segment file.
withinTumor	Cluster Tumor average CCF within tumors in each patients. Default FALSE.
use.tumorSampleLabel	Logical (Default: FALSE). Rename the 'Tumor_Sample_Barcode' by 'Tumor_Sample_Label'.
...	Other options passed to <a href="#">subMaf</a>

**Value**

clustering plots of vaf

**Examples**

```
maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccfFile=ccf.File, refBuild="hg19")
mutCluster(maf, patient.id = 'V402')
```

---

mutHeatmap

*mutHeatmap*


---

**Description**

plot binary or CCF heatmap of somatic mutations.

**Usage**

```
mutHeatmap(
  maf,
  patient.id = NULL,
  min.vaf = 0,
  min.ccf = 0,
  use.adjVAF = FALSE,
  use.ccf = FALSE,
  geneList = NULL,
  plot.geneList = FALSE,
  show.geneList = TRUE,
  mut.threshold = 50,
  sample.text.size = 9,
  legend.title.size = 10,
  gene.text.size = 9,
```

```

    sampleOrder = NULL,
    use.tumorSampleLabel = FALSE,
    classByTumor = FALSE,
    ...
  )

```

### Arguments

maf	Maf or MafList object generated by <a href="#">readMaf</a> function.
patient.id	Select the specific patients. Default NULL, all patients are included.
min.vaf	The minimum value of VAF. Default 0. Option: on the scale of 0 to 1.
min.ccf	The minimum value of CCF. Default 0. Option: on the scale of 0 to 1.
use.adjVAF	Use adjusted VAF in analysis when adjusted VAF or CCF is available. Default FALSE.
use.ccf	Logical. If FALSE (Default: FALSE), print a binary heatmap of mutations. Otherwise, print a cancer cell frequency (CCF) heatmap.
geneList	List of genes to restrict the analysis. Default NULL.
plot.geneList	Logical (Default: FALSE). If TRUE, plot heatmap with genes on geneList when geneList is not NULL.
show.geneList	Show the names of gene on the geneList. Default TRUE.
mut.threshold	show.gene and show.geneList will be FALSE when patient have more mutations than threshold. Default 150.
sample.text.size	Size of sample name.Default 9.
legend.title.size	Size of legend title.Default 10.
gene.text.size	Size of gene text. Default 9.
sampleOrder	A named list which contains the sample order used in plotting the heatmap. Default NULL.
use.tumorSampleLabel	Logical (Default: FALSE). Rename the 'Tumor_Sample_Barcode' by 'Tumor_Sample_Label'.
classByTumor	Logical Default: FALSE. Classify mutations based on "Tumor_ID".
...	Other options passed to <a href="#">subMaf</a>

### Value

heatmap of somatic mutations

### Examples

```

maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccfFile=ccf.File, refBuild="hg19")
mutHeatmap(maf)

```

---

mutTrunkBranch	<i>mutTrunkBranch</i>
----------------	-----------------------

---

## Description

Summarize and conduct paired Fisher test of mutations of trunk/branches in a phylogenetic tree.

## Usage

```
mutTrunkBranch(  
  phyloTree,  
  patient.id = NULL,  
  CT = FALSE,  
  pvalue = 0.05,  
  plot = TRUE  
)
```

## Arguments

phyloTree	phyloTree or phyloTreeList object generated by <a href="#">getPhyloTree</a> function.
patient.id	Select the specific patients. Default NULL, all patients are included
CT	Distinction between C>T at CpG and C>T at other sites. (Default: FALSE).
pvalue	Confidence level of the interval for Fisher test. Default 0.05.
plot	Logical. (Default: TRUE).

## Value

a list of box plots based on mutational categories

## Examples

```
maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")  
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")  
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")  
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccfFile=ccf.File, refBuild="hg19")  
  
## Load a reference genome.  
library(BSgenome.Hsapiens.UCSC.hg19)  
  
phyloTree <- getPhyloTree(maf, patient.id = 'V402')  
mutTrunkBranch(phyloTree, plot = TRUE)
```

---

phyloTree-class      *phyloTree class*

---

**Description**

S4 class for storing informations about phylogenetic tree.

**Slots**

patientID patient ID.

tree a object of class "phylo".

bootstrap.value a numeric vector of bootstrap values.

method approach to construct a phylogenetic tree.

binary.matrix a presense/absent binary matrix of mutations.

ccf.matrix a ccf matrix of mutations.

mut.branches a data.frame of mutations per trunk/branch.

branch.type a data.frame of trunk/branch types based on shared pattern.

ref.build human reference genome version. Default: 'hg19'. Optional: 'hg18' or 'hg38'.

tsb.label store relationship between Tumor\_Sample\_Barcode and Tumor\_Sample\_Label if Tumor\_Sample\_Label is provided in clinical data.

---

phyloTreeList-class      *phyloTreeList class*

---

**Description**

S4 class for storing a list of phyloTree objects.

**Slots**

.Data a list of [phyloTree](#) objects.

**Constructor**

phyloTreeList (...) combine multiple phyloTree objects supplied in ... into a phyloTreeList object.

---

plotCNA

*plotCNA*


---

### Description

plotCNA

### Usage

```
plotCNA(
  seg,
  patient.id = NULL,
  sampleOrder = NULL,
  chrSilent = NULL,
  refBuild = "hg19",
  sample.text.size = 11,
  chrom.text.size = 3,
  legend.text.size = 9,
  legend.title.size = 11,
  annot.text.size = 3,
  sample.bar.height = 0.5,
  chrom.bar.height = 0.5,
  showRownames = TRUE,
  removeEmptyChr = TRUE,
  showCytoband = FALSE,
  showGene = FALSE,
  use.tumorSampleLabel = FALSE
)
```

### Arguments

seg	Object generated by <a href="#">readSegment</a> function.
patient.id	Select the specific patients. Default NULL, all patients are included.
sampleOrder	A named list which contains the sample order used in plotting the final profile. Default NULL.
chrSilent	Chromosomes excluded in the analysis. e.g, 1, 2, 3. Default NULL.
refBuild	Human reference genome versions of hg18, hg19 or hg38 by UCSC. Default "hg19".
sample.text.size	Fontsize of sample name. Default 11.
chrom.text.size	Fontsize of chromosome text. Default 3.
legend.text.size	Fontsize of legend text. Default 9.

legend.title.size	Fontsize of legend title. Default 11.
annot.text.size	Fontsize of cytoband or gene symbols. Default 3.
sample.bar.height	Bar height of each sample. Default 0.5.
chrom.bar.height	Bar height of each chromosome. Default 0.5.
showRownames	Logical (Default: TRUE). Show sample names of rows.
removeEmptyChr	Remove empty chromosomes that do not exist in all samples. Default TRUE.
showCytoband	Logical (Default: FALSE). Show cytobands on the plot. Only when the seg object is created with GISTIC results, this parameter can be TRUE.
showGene	Logical (Default: FALSE). Show gene symbols on the plot. Only when the seg object is created with txdb, this parameter can be TRUE.
use.tumorSampleLabel	Logical (Default: FALSE). Rename the 'Tumor_Sample_Barcode' with 'Tumor_Sample_Label'.

**Value**

a heatmap plot of CNA profile

**Examples**

```
segFile <- system.file("extdata", "CRC_HZ.seg.txt", package = "MesKit")
seg <- readSegment(segFile = segFile)
plotCNA(seg)

## showCytoband
gisticAmpGenesFile <- system.file("extdata", "COREAD_amp_genes.conf_99.txt", package = "MesKit")
gisticDelGenesFile <- system.file("extdata", "COREAD_del_genes.conf_99.txt", package = "MesKit")
gisticAllLesionsFile <- system.file("extdata", "COREAD_all_lesions.conf_99.txt", package = "MesKit")
seg <- readSegment(segFile = segFile,
                  gisticAmpGenesFile = gisticAmpGenesFile,
                  gisticDelGenesFile = gisticDelGenesFile,
                  gisticAllLesionsFile = gisticAllLesionsFile)
plotCNA(seg, showCytoband = TRUE)
```

---

plotMutProfile

*plotMutProfile*


---

**Description**

plotMutProfile

**Usage**

```

plotMutProfile(
  maf,
  patient.id = NULL,
  class = "SP",
  classByTumor = FALSE,
  topGenesCount = 10,
  geneList = NULL,
  sample.text.size = 11,
  gene.text.size = 11,
  legend.text.size = 11,
  legend.title.size = 11,
  bgCol = "#f0f0f0",
  patientsCol = NULL,
  removeEmptyCols = TRUE,
  removeEmptyRows = TRUE,
  showColnames = TRUE,
  sampleOrder = NULL,
  use.tumorSampleLabel = FALSE,
  ...
)

```

**Arguments**

maf	Maf or MafList object generated by <a href="#">readMaf</a> function.
patient.id	Select or reorder the patients. Default NULL, all patients are included. Classify SSNVs/Indels into Shared/P-shared/Private, Clonal/Subclonal or Shared-Clonal/P-shared-Clonal/Private-Clonal/Shared-Subclonal/P-shared-SubClonal/Private-SubClonal
class	The class which would be represented. Default "SP" (Shared pattern: Public/Shared/Private), other options: "CS" (Clonal status: Clonal/Subclonal) and "SPCS".
classByTumor	Logical (Default: FALSE). Define shared pattern of mutations based on tumor types (TRUE) or samples (FALSE)
topGenesCount	The number of genes print, Default 10.
geneList	A list of genes to restrict the analysis. Default NULL.
sample.text.size	Fontsize of sample name. Default 11.
gene.text.size	Fontsize of gene text. Default 11.
legend.text.size	Fontsize of legend text. Default 11.
legend.title.size	Fontsize of legend title. Default 11.
bgCol	Background grid color. Default "#f0f0f0".
patientsCol	A list containing customized colors for distinct patients. Default NULL.



removeEmptyCols Logical (Default: TRUE). Whether remove the samples without alterations.

removeEmptyRows Logical (Default: TRUE). Whether remove the genes without alterations.

showColnames Logical (Default: TRUE). Show sample names of columns.

sampleOrder A named list which contains the sample order used in plotting the final profile. Default NULL.

use.tumorSampleLabel Logical (Default: FALSE). Rename the 'Tumor\_Sample\_Barcode' with 'Tumor\_Sample\_Label'.

... Other options passed to [subMaf](#)

**Value**

Mutational profile

**Examples**

```
maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccfFile=ccf.File, refBuild="hg19")
plotMutProfile(maf, class = "SP")
```

---

plotMutSigProfile      *plotMutSigProfile*

---

**Description**

plotMutSigProfile

**Usage**

```
plotMutSigProfile(
  sig_input,
  patient.id = NULL,
  mode = NULL,
  contribution.type = "relative",
  use.tumorSampleLabel = FALSE
)
```

**Arguments**

sig\_input Result generated by function [fitSignatures](#) or [triMatrix](#).

patient.id Select the specific patients. Default NULL, all patients are included.

mode Type of mutation spectrum. Default NULL. Options: 'Original', 'Reconstructed' or 'Difference'

```

contribution.type
    Type of Signature contribution. Default 'relative'. Options: 'relative' or 'absolute'.
use.tumorSampleLabel
    Logical (Default: FALSE). Rename the 'Tumor_Sample_Barcode' by 'Tumor_Sample_Label'.

```

**Value**

Mutational signature profile of patients

**Examples**

```

## input from fitSignatures
maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccfFile=ccf.File, refBuild="hg19")
phyloTree <- getPhyloTree(maf, patient.id = 'V402')

## Load a reference genome.
library(BSgenome.Hsapiens.UCSC.hg19)

tri_matrix <- triMatrix(phyloTree)
fit_out <- fitSignatures(tri_matrix)
plotMutSigProfile(fit_out)
## input from treeMatrix
plotMutSigProfile(tri_matrix)

```

---

plotPhyloTree	<i>plotPhyloTree</i>
---------------	----------------------

---

**Description**

plotPhyloTree

**Usage**

```

plotPhyloTree(
  phyloTree,
  patient.id = NULL,
  branchCol = "mutType",
  show.bootstrap = TRUE,
  min.ratio = 1/20,
  signaturesRef = "cosmic_v2",
  min.mut.count = 15,
  use.tumorSampleLabel = FALSE,
  show.scale.bar = FALSE,
  scale.bar.x = NULL,

```

```

    scale.bar.y = NULL
  )

```

### Arguments

phyloTree	phyloTree or phyloTreeList object generated by <a href="#">getPhyloTree</a> function.
patient.id	Select the specific patients. Default NULL, all patients are included.
branchCol	Specify the colors of branches Default 'mutType'. Other options: "mutSig" for coloring branches by branch mutation signature;
show.bootstrap	Logical (Default: TRUE). Whether to add bootstrap value on internal nodes.
min.ratio	Double. Default 1/20. If min.ratio is not NULL, all edge length of a phylogenetic tree should be greater than min.ratio*the longest edge length. If not, the edge length will be reset as min.ratio*longest edge length.
signaturesRef	Signature reference,Users can upload their own reference. Default "cosmic_v2". Option:"exome_cosmic_v3","nature2013".
min.mut.count	The threshold for the variants in a branch. Default 15.
use.tumorSampleLabel	Logical (Default: FALSE). Rename the 'Tumor_Sample_Barcode' with 'Tumor_Sample_Label'.
show.scale.bar	Logical (Default: FALSE). Whether to show scale bar.This function adds a horizontal bar giving the scale of the branch lengths to a plot on the current graphical device.
scale.bar.x	The x location of scale bar.
scale.bar.y	The y location of scale bar.

### Value

return a list of phylotree graph .

### Examples

```

maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccfFile=ccf.File, refBuild="hg19")

phyloTree <- getPhyloTree(maf, patient.id = 'V402')
plotPhyloTree(phyloTree)

```

---

readMaf	<i>readMaf</i>
---------	----------------

---

### Description

Read tab delimited MAF (can be plain text or \*.gz compressed) file along with sample information file.

### Usage

```
readMaf(
  mafFile,
  clinicalFile,
  ccffile = NULL,
  adjusted.VAF = FALSE,
  nonSyn.vc = NULL,
  use.indel.ccf = FALSE,
  ccf.conf.level = 0.95,
  refBuild = "hg19"
)
```

### Arguments

mafFile	A tab delimited MAF file (plain text or *.gz compressed). Required.
clinicalFile	A clinical data file includes Tumor_Sample_Barcode, Tumor_ID, Patient_ID. Tumor_Sample_Label is optional. Default NULL.
ccffile	A CCF file of somatic mutations. Default NULL.
adjusted.VAF	Whether adjusted VAF is included in mafFile. Default FALSE.
nonSyn.vc	List of Variant classifications which are considered as non-silent. Default NULL, use Variant Classifications with "Frame_Shift_Del", "Frame_Shift_Ins", "Splice_Site", "Translation_Start"
use.indel.ccf	Whether include indels in ccffile. Default FALSE.
ccf.conf.level	The confidence level of CCF to identify clonal or subclonal. Only works when "CCF_std" or "CCF_CI_high" is provided in ccffile. Default 0.95.
refBuild	Human reference genome version. Default 'hg19'. Optional: 'hg18' or 'hg38'.

### Value

an object of Maf or MafList.

### Examples

```
maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, refBuild="hg19")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccffile=ccf.File, refBuild="hg19")
```

---

readSegment	<i>readSegment</i>
-------------	--------------------

---

## Description

readSegment

## Usage

```
readSegment(
  segFile,
  gisticAmpGenesFile = NULL,
  gisticDelGenesFile = NULL,
  gisticAllLesionsFile = NULL,
  gistic.qval = 0.25,
  min.seg.size = 500,
  txdb = NULL,
  min.overlap.len = 50,
  verbose = TRUE,
  ...
)
```

## Arguments

segFile	The segment file.
gisticAmpGenesFile	Amplification Genes file generated by GISTIC. Default NULL.
gisticDelGenesFile	Deletion Genes file generated by GISTIC. Default NULL.
gisticAllLesionsFile	Information of all lesions generated by GISTIC. Default NULL.
gistic.qval	The threshold of gistic Q value. Default 0.25.
min.seg.size	The smallest size of segments. Default 500.
txdb	A TxDb object. i.e., TxDb.Hsapiens.UCSC.hg19.knownGene. Default NULL.
min.overlap.len	The minimum insertion size of segment and gene. Default 50.
verbose	Whether to display details in the console. Default TRUE.
...	... Other options passed to <a href="#">cna2gene</a> .

## Value

a list of segmentation data frame

## Examples

```
segFile <- system.file("extdata", "CRC_HZ.seg.txt", package = "MesKit")
gisticAmpGenesFile <- system.file("extdata", "COREAD_amp_genes.conf_99.txt", package = "MesKit")
gisticDelGenesFile <- system.file("extdata", "COREAD_del_genes.conf_99.txt", package = "MesKit")
gisticAllLesionsFile <- system.file("extdata", "COREAD_all_lesions.conf_99.txt", package = "MesKit")
seg <- readSegment(segFile = segFile,
                  gisticAmpGenesFile = gisticAmpGenesFile,
                  gisticDelGenesFile = gisticDelGenesFile,
                  gisticAllLesionsFile = gisticAllLesionsFile)
```

---

runMesKit

*Run the default MesKit app for analysis locally*

---

## Description

runMesKit run MesKit locally

## Usage

```
runMesKit()
```

## Value

a shiny app window

## Author(s)

Mengni Liu

## Examples

```
runMesKit()
```

---

subMaf

*Subset Maf object*

---

## Description

Subset Maf object

**Usage**

```

subMaf(
  maf,
  mafObj = FALSE,
  patient.id = NULL,
  geneList = NULL,
  chrSilent = NULL,
  mutType = "All",
  use.indel = TRUE,
  min.vaf = 0,
  max.vaf = 1,
  min.average.vaf = 0,
  min.ccf = 0,
  min.ref.depth = 0,
  min.alt.depth = 0,
  min.total.depth = 0,
  clonalStatus = NULL,
  use.adjVAF = FALSE,
  use.tumorSampleLabel = FALSE
)

```

**Arguments**

maf	Maf or MafList object generated by <a href="#">readMaf</a> function.
mafObj	return Maf class. (Default: FALSE).
patient.id	Select the specific patients. Default NULL, all patients are included.
geneList	A list of genes to restrict the analysis. Default NULL.
chrSilent	Chromosomes excluded in the analysis. e.g, 1, 2, X, Y. Default NULL.
mutType	Select Proper variant classification you need. Default "All". Option: "nonSyn".
use.indel	Logical value. Whether to use INDELs besides somatic SNVs. (Default: TRUE).
min.vaf	The minimum VAF for filtering variants. Default 0.
max.vaf	The maximum VAF for filtering variants. Default 1.
min.average.vaf	The minimum tumor average VAF for filtering variants. Default 0.
min.ccf	The minimum CCF for filtering variants. Default NULL.
min.ref.depth	The minimum reference allele depth for filtering variants. Default 0.
min.alt.depth	The minimum alteration allele depth for filtering variants. Default 0.
min.total.depth	The minimum total allele depth for filtering variants. Default 0.
clonalStatus	Subset by clonal status. Default NULL. Option: "Clonal","Subclonal".
use.adjVAF	Use adjusted VAF in analysis when adjusted VAF or CCF is available. Default FALSE.
use.tumorSampleLabel	Logical (Default: FALSE). Rename the 'Tumor_Sample_Barcode' by 'Tumor_Sample_Label'.

**Value**

Maf object or Maf data.

**Examples**

```
maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccfFile=ccf.File, refBuild="hg19")
maf_data <- subMaf(maf)
```

---

testNeutral

*testNeutral*


---

**Description**

Evaluate whether a tumor follows neutral evolution or under strong selection during the growth based on variant frequency distribution (VAF) of subclonal mutations. The subclonal mutant allele frequencies of a follow a simple power-law distribution predicted by neutral growth.

**Usage**

```
testNeutral(
  maf,
  patient.id = NULL,
  withinTumor = FALSE,
  min.total.depth = 2,
  min.vaf = 0.1,
  max.vaf = 0.3,
  R2.threshold = 0.98,
  min.mut.count = 20,
  plot = TRUE,
  use.tumorSampleLabel = FALSE,
  ...
)
```

**Arguments**

maf	Maf or MafList object generated by <a href="#">readMaf</a> function.
patient.id	Select the specific patients. Default NULL, all patients are included.
withinTumor	Test neutral within tumors in each patients. Default FALSE.
min.total.depth	The minimum total depth of coverage. Default 2
min.vaf	The minimum value of adjusted VAF value. Default 0.1
max.vaf	The maximum value of adjusted VAF value. Default 0.3



R2.threshold	The threshold of R2 to decide whether a tumor follows neutral evolution. Default 0.98
min.mut.count	The minimum number of subclonal mutations used to fit model. Default 20
plot	Logical, whether to print model fitting plot of each sample. Default TRUE.
use.tumorSampleLabel	Let Tumor_Sample_Barcode replace Tumor_Sample_Label if Tumor Label is provided in clinical data. Default FALSE.
...	Other options passed to <a href="#">subMaf</a>

**Value**

the neutrality metrics and model fitting plots

**References**

Williams, M., Werner, B. et al. Identification of neutral tumor evolution across cancer types. *Nat Genet* 48, 238-244 (2016)

**Examples**

```
maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccfFile=ccf.File, refBuild="hg19")
testNeutral(maf)
```

---

triMatrix

*triMatrix*


---

**Description**

Calculate the frequency of 96 trinucleotide mutation based on somatic SNVs.

**Usage**

```
triMatrix(phyloTree, patient.id = NULL, level = 2)
```

**Arguments**

phyloTree	phyloTree or phyloTreeList object generated by <a href="#">getPhyloTree</a> function.
patient.id	Select the specific patients. Default NULL, all patients are included
level	Calculate the frequency of 96 trinucleotide mutation on different levels. 1: patient-level, 2: tumor-level, 3: sample-level, 4: branch-level, 5: shared pattern (public/shared/private) of each tumor. 6: trunk/branch-level. Default 2.

**Value**

The frequency of 96 trinucleotide mutation.

**Examples**

```
maf.File <- system.file("extdata/", "CRC_HZ.maf", package = "MesKit")
clin.File <- system.file("extdata/", "CRC_HZ.clin.txt", package = "MesKit")
ccf.File <- system.file("extdata/", "CRC_HZ.ccf.tsv", package = "MesKit")
maf <- readMaf(mafFile=maf.File, clinicalFile = clin.File, ccfFile=ccf.File, refBuild="hg19")

## Load a reference genome.
library(BSgenome.Hsapiens.UCSC.hg19)

phyloTree <- getPhyloTree(maf, patient.id = 'V402')
triMatrix(phyloTree)
```

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