

# Package ‘SMITIDstruct’

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**Title** Data Structure and Manipulations Tool for Host and Viral Population

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**Description** Statistical Methods for Inferring Transmissions of Infectious Diseases from deep sequencing data (SMITID).

It allow sequence-space-time host and viral population data storage, indexation and querying.

**License** GPL (>= 2) | file LICENSE

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<https://gitlab.paca.inra.fr/SMITID/structR>

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SMITIDstruct-package    *Data Structure and Manipulation Tool for Host and Viral Population*

---

## Description

Statistical Methods for Inferring Transmissions of Infectious Diseases from deep sequencing data (SMITID). It allow sequence-space-time host and viral population data storage, indexation and querying.

## Details

Package: SMITIDstruct  
Type: Package  
Version: 0.0.5  
Date: 2019-06-14  
License: GPL (>=2)

The SMITIDstruct package contains functions and methods for manipulating Host and Viral population genotico-space-time data.

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## See Also

[demo.SMITIDstruct.run](#)

## Examples

```
## Run a simulation
library("SMITIDstruct")
demo.SMITIDstruct.run()
```

---

addcode	<i>addcode</i>
---------	----------------

---

**Description**

add a code event to an another

**Usage**

```
addcode(code, code.add)
```

**Arguments**

code	an existing code
code.add	the code to add

**Value**

merge of the two code

---

addHost	<i>addHost</i>
---------	----------------

---

**Description**

add an Host to a HostSet

**Usage**

```
addHost(lhost, id)
```

**Arguments**

lhost	a hostSet Object
id	a character of host ID

**Value**

a HostSet of host object with there ID

**Examples**

```
lhost <- list()  
lhost <- addHost(lhost,"42")
```

---

addIndex	<i>addIndex</i>
----------	-----------------

---

**Description**

add to an index a new eventcode

**Usage**

```
addIndex(index, id_host, time, code)
```

**Arguments**

index	an index
id_host	an host index in HostSet
time	a time
code	an event code

**Value**

the index updated (add a row or update one)

---

addViralObs	<i>addViralObs</i>
-------------	--------------------

---

**Description**

load Viral pop observation in Host object

**Usage**

```
addViralObs(lhost, lvpop)
```

**Arguments**

lhost	a HostSet
lvpop	a ViralPopSet

**Value**

lhost update with viral population observed

---

 alleleCount

*alleleCount*


---

**Description**

count allele at each position

**Usage**

```
alleleCount(mat, seq.char = c("A", "T", "G", "C"))
```

**Arguments**

mat	a genomique seq list as matrix by row
seq.char	allele alphabet

**Value**

a matrix, each row as a unique seq and col as allele count by position

---

 concatViralPop

*concatViralPop*


---

**Description**

concat several Viral population in one ViralPop object

**Usage**

```
concatViralPop(lvpop, lid)
```

**Arguments**

lvpop	a ViralPop Set
lid	vector of viralpop id to concat

**Value**

a ViralPop object with ID concatenation from all IDs and time at 0.

---

createAViralPop	<i>createAViralPop</i>
-----------------	------------------------

---

**Description**

Create a new ViralPop object

**Usage**

```
createAViralPop(host_id, obs_time, seq, id_seq = "seq_ID",
  seq_value = "seq", prop = "prop", compact = FALSE)
```

**Arguments**

host_id	host ID which viral pop is observed
obs_time	time of the observation (numeric or date)
seq	a data.frame of sequences ID, sequences and counts
id_seq	column name containing the sequences ID
seq_value	column name containing the sequences
prop	column name containing the count of each sequences
compact	boolean, default FALSE, if TRUE will try group identicals sequences (not implemented yet)

---

createHost	<i>createHost</i>
------------	-------------------

---

**Description**

create a list of Host class object

**Usage**

```
createHost(list_host)
```

**Arguments**

list_host	a character vector of host ID
-----------	-------------------------------

**Value**

a HostSet of host object with there ID

**Examples**

```
lh <- seq(1,30,1)
lhost <- createHost(lh)
```

createIndex            *createIndex*

---

**Description**

create an index of time id\_host and event code

**Usage**

createIndex(hostlist)

**Arguments**

hostlist            a Hostset

**Value**

a data.frame with TIME, ID\_HOST and EVENTCODE as columns

---

demo.SMITIDstruct.run    *demo.SMITIDstruct.run*

---

**Description**

run a demo to load HostSet, ViralPopSet and index

**Usage**

demo.SMITIDstruct.run()

---

diversity.pDistance    *diversity.pDistance*

---

**Description**

diversity calculation using Mean Pairwise Distance

**Usage**

diversity.pDistance(vpop)

**Arguments**

vpop                a ViralPop object

**Value**

result



---

diversity.sfs	<i>diversity.sfs</i>
---------------	----------------------

---

**Description**

Allele frequency spectrum or Site frequency spectra : the distribution of alternative allele frequencies across all sites of genetic sequences

**Usage**

```
diversity.sfs(vpop)
```

**Arguments**

vpop            a viralPop class

**Value**

the site frequency spectra

---

getCov	<i>getCov</i>
--------	---------------

---

**Description**

get Host(s) covariates

**Usage**

```
getCov(lhost, id = NA)
```

**Arguments**

lhost            a HostSet  
id                a vector of host id (default NA : all lhost)

**Value**

a data.frame

---

<code>getDate</code>	<i>getDate</i>
----------------------	----------------

---

**Description**

Converte timestamp to Date (string)

**Usage**

```
getDate(time, format = "%Y-%m-%dT%H:%M:%S")
```

**Arguments**

<code>time</code>	a timestamp or vector of
<code>format</code>	Date format output (default <code>%Y-%m-%dT%H:%M:%S</code> )

**Value**

time as string date

---

<code>getDiversity.pDistance</code>	<i>getDiversity.pDistance</i>
-------------------------------------	-------------------------------

---

**Description**

get pairwise distance of an host over viral population observed

**Usage**

```
getDiversity.pDistance(host, lvpop)
```

**Arguments**

<code>host</code>	an Host object
<code>lvpop</code>	a ViralPopSet object

**Value**

a data.frame with col as time of observation and `p_distance`

---

*getDiversity.sfs*      *getDiversity.sfs*

---

**Description**

get Allele Frequency Spectrum or Site Frequency spectra for observed viral pop of an host

**Usage**

`getDiversity.sfs(host, lvpop)`

**Arguments**

host	an Host object
lvpop	an ViralPopSet object

**Value**

a list indexed by time that contains allele.time and count

---

*getInfosByHostAndTime*    *getInfosByHostAndTime*

---

**Description**

get hosts informations, status, infectedby, coordinates and time

**Usage**

`getInfosByHostAndTime(index, lhost)`

**Arguments**

index	an index
lhost	a hosts list

**Value**

a data.frame with colnames (id, time, infectedby, status, probabilities, X ,Y)

---

`getStates`*getStates*

---

**Description**

get Host(s) states

**Usage**

```
getStates(lhost, id = NA)
```

**Arguments**

<code>lhost</code>	a HostSet
<code>id</code>	a vector of host id (default NA : all lhost)

**Value**

a data.frame

---

`getTimeLine`*getTimeLine*

---

**Description**

get the time line of an host

**Usage**

```
getTimeLine(lhost, id)
```

**Arguments**

<code>lhost</code>	a hostSet
<code>id</code>	a host ID

**Value**

a data.frame

---

getTimestamp	<i>getTimestamp</i>
--------------	---------------------

---

**Description**

Get the timestamp of Date

**Usage**

```
getTimestamp(date, format = "%Y-%m-%dT%H:%M:%S")
```

**Arguments**

date	a date (as string) or vector of
format	the date format (default %Y-%m-%dT%H:%M:%S)

**Value**

timestamp of the date(s)

---

getTransmissionTree	<i>getTransmissionTree</i>
---------------------	----------------------------

---

**Description**

get a transmission tree as a data.frame

**Usage**

```
getTransmissionTree(lhost, id = NA)
```

**Arguments**

lhost	a hostSet
id	a vector of hosts ids (default NA : all host)

**Value**

a data.frame as source|target|time in columns

**Examples**

```
path = system.file("extdata", "data-simul/", package="SMITIDstruct")
lhost <- list()
lhost <- loadTree(lhost, paste(path, "/tree.txt", sep=' '))
print(getTransmissionTree(lhost))
```

---

Host	<i>Class Host</i>
------	-------------------

---

### Description

Spatio-temporal information about Host.

### Details

Object can be created by calling ...  
 rdname Host-class

### Slots

ID Host identifier  
 coordinates Host coordinates in time (as sf)  
 states Host States/Status (dob, Inf...)  
 sources data.frame of time and host id who infected this host  
 offsprings data.frame of time and host id who has been contaminated by this host  
 ID\_V\_POP data.frame of time and index of Viral population Observation  
 covariates data.frame of time, cavariate and value of this host.

---

is.juliendate	<i>is.juliendate</i>
---------------	----------------------

---

### Description

Check if a numeric is not a timestamp

### Usage

```
is.juliendate(time)
```

### Arguments

time            a numeric

### Value

TRUE if time is a julien day, otherwise FALSE

---

`is.StringDate`                      *is.StringDate*

---

**Description**

Check if a string represent a date

**Usage**

`is.StringDate(date)`

**Arguments**

`date`                      a string or a vector of string (without NA)

**Value**

TRUE if date contains date format

---

`is.timestamp`                      *is.timestamp*

---

**Description**

Check if a numeric represent a timestamp

**Usage**

`is.timestamp(time)`

**Arguments**

`time`                      a numeric

**Value**

TRUE if time >= 1971

---

isInCode	<i>isInCode</i>
----------	-----------------

---

**Description**

check a code contains a specific code

**Usage**

```
isInCode(code, thecode)
```

**Arguments**

code	list of code to test
thecode	the real code

**Value**

TRUE if code contain thecode otherwise FLASE

---

loadCoords	<i>loadCoords</i>
------------	-------------------

---

**Description**

Load Hosts states

**Usage**

```
loadCoords(lhost, dfCoords, id = "ID")
```

**Arguments**

lhost	a HostSet
dfCoords	a data.frame with host ID, time and longitude latitude values
id	colname for host ID

**Value**

lhost updated

**Examples**

```
path = system.file("extdata", "data-simul/", package="SMITIDstruct")
lhost <- list()
lhost <- loadTree(lhost, paste(path, "/tree.txt", sep=' '))
coords <- read.table(file=paste(path, "/hosts_coords.txt", sep=' '), header=TRUE, check.names=FALSE)
lhost <- loadCoords(lhost, coords)
```



---

loadCovs	<i>loadCovs</i>
----------	-----------------

---

**Description**

Load Hosts covariates

**Usage**

```
loadCovs(lhost, dfCovs, id = "ID", colCovs)
```

**Arguments**

lhost	a HostSet
dfCovs	a data.frame with host ID in rows and covariates in columns
id	colname for host ID
colCovs	colnames of covariates columns

**Value**

lhost updated with covariates

---

loadHost	<i>loadHost</i>
----------	-----------------

---

**Description**

load host object from a file

**Usage**

```
loadHost(file = "host.txt")
```

**Arguments**

file	a file containing hosts data
------	------------------------------

**Value**

a list of Host object (HostSet) include Class-Host.R

---

loadStates	<i>loadStates</i>
------------	-------------------

---

**Description**

Load Hosts states

**Usage**

```
loadStates(lhost, dfStates, id = "ID", colStates)
```

**Arguments**

lhost	a HostSet
dfStates	a data.frame with host ID and states in columns and time as value
id	colname for host ID
colStates	colnames of States columns

**Value**

lhost updated

**Examples**

```
path = system.file("extdata", "data-simul/", package="SMITIDstruct")
lhost <- list()
class(lhost) <- "hostSet"
lhost <- loadTree(lhost, paste(path, "/tree.txt", sep=''))
obs <- read.table(paste(path, "/obs.txt", sep=''), header=TRUE, check.names=FALSE)
obs.states <- c(colnames(obs[-grep("ID|Tobs.*", colnames(obs))]))
lhost <- loadStates(lhost, obs, colStates=obs.states)
```

---

loadTree	<i>loadTree</i>
----------	-----------------

---

**Description**

load sources and offsprings from file

**Usage**

```
loadTree(lhost = list(), file = "tree.txt", source = "ID-source",
receptor = "ID-receptor", tinf = "Tinf", weight = "Weight")
```

**Arguments**

lhost	a HostSet
file	a file containing tree data
source	column name for source ID
receptor	column name for receptor ID
tinf	column name for infection Time
weight	column name of infection weight

**Value**

the lhost param update with sources and offsprings

**Examples**

```
path = system.file("extdata", "data-simul/", package="SMITIDstruct")
lhost <- list()
class(lhost) <- "hostSet"
lhost <- loadTree(lhost, paste(path, "/tree.txt", sep=' '))
```

---

loadTreeDF

*loadTreeDF*


---

**Description**

load sources and offsprings from a data.frame

**Usage**

```
loadTreeDF(lhost = list(), df = data.frame(), source = "ID-source",
  receptor = "ID-receptor", tinf = "Tinf", weight = "Weight")
```

**Arguments**

lhost	a HostSet
df	a data.frame containing tree data
source	column name for source ID
receptor	column name for receptor ID
tinf	column name for infection Time
weight	infection links probability

**Value**

the lhost param update with sources and offsprings

---

loadViralObs	<i>loadViralObs</i>
--------------	---------------------

---

**Description**

load a ViralPop object

**Usage**

```
loadViralObs(id, time, file)
```

**Arguments**

id	host pathogen ID
time	time of the observation (numeric or Date)
file	a fasta file

**Value**

a new ViralPop object

---

loadViralPop	<i>loadViralPop</i>
--------------	---------------------

---

**Description**

Load all ViralPop observed in the file.obs

**Usage**

```
loadViralPop(directory, listFiles, listCol = list(id = "id", timeObs =
  "time", filename = "filename"), file.extension = "fasta")
```

**Arguments**

directory	path where is data
listFiles	a dataframe with host ID, time observation and file name (filename.fasta)
listCol	a list of listFiles columns names ("id", "timeObs", "filename")
file.extension	genotype file extension

**Value**

a vector of ViralPop object

**Examples**

```

path = system.file("extdata", "data-simul/", package="SMITIDstruct")
files <- list.files(path, pattern = ".*.fasta" ,full.names=FALSE)
lfileinfo <- sapply(files,function(x){return(substr(x,1,nchar(x)-6))})
splitFiles <- strsplit(lfileinfo, "_");
listF <- cbind(data.frame(matrix(unlist(splitFiles),nrow=length(splitFiles), byrow=TRUE),
                              stringsAsFactors = FALSE), names(splitFiles))
colnames(listF) <- c("id", "time", "filename")
lvpop <- loadViralPop(path,listF)

```

---

loadViralPopSet	<i>loadViralPopSet</i>
-----------------	------------------------

---

**Description**

load a list of viral populations

**Usage**

```
loadViralPopSet(lvpop = list(), list)
```

**Arguments**

lvpop	a viralPopSet (default new one)
list	a list (see details)

**Details**

The list have to be on this format: list\$HOST\_ID\$TIME\$list\$seq\_id \$seq \$prop A list indexed by host ID, follow by a list indexed by time (of observation). The last list contains an array of seq\_ID (sequence ID), an array of seq (sequence as characters), and an array of the count of seq. example : \$'HOST\_42'\$'2014-01-01T00:00:00'\$seq\_ID ["SEQ\_1","SEQ\_2"] \$'HOST\_42'\$'2014-01-01T00:00:00'\$seq ["ACGT","TGCA"] \$'HOST\_42'\$'2014-01-01T00:00:00'\$seq\_ID ["46","6"]

---

mergeCode	<i>mergeCode</i>
-----------	------------------

---

**Description**

merge a list of event code

**Usage**

```
mergeCode(listcode)
```

**Arguments**

listcode          a list of event code\*

**Value**

a code

---

plotDiversity.pDistance

*plotDiversity.pDistance*

---

**Description**

plot Mean Pairwise Distance for an host viralpop over time

**Usage**

plotDiversity.pDistance(host, lvpop)

**Arguments**

host              an Host object

lvpop             a ViralPopSet object

---

plotDiversity.sfs

*plotDiversity.sfs*

---

**Description**

plot Allele frequency spetrum for an host viralpop over time

**Usage**

plotDiversity.sfs(host, lvpop)

**Arguments**

host              an Host object

lvpop             an ViralPopSet object

---

setStates	<i>setStates</i>
-----------	------------------

---

**Description**

set hosts states from a data.frame

**Usage**

```
setStates(lhost, dfStates, colStates = c(id = "ID", time = "time", states  
= "value"))
```

**Arguments**

lhost	a HostSet
dfStates	a data.frame with host ID and states and time in columns
colStates	vector of the columns name, id, time and states

**Value**

the HostSet updated

---

simulateStates	<i>simulateStates</i>
----------------	-----------------------

---

**Description**

simulate states from sources infection

**Usage**

```
simulateStates(lhost)
```

**Arguments**

lhost	a HostSet
-------	-----------

**Value**

lhost update with states from sources time ~

---

ViralPop

*Class ViralPop*

---

**Description**

Viral population data containing genotypes

**Slots**

ID Host identifier

time Observation time as numeric since 1970/01/01

size Qt of variants

names list of variants id with same sequence

genotypes all variants genotypes (as DNAStrngSet)

proportions proportions of each variants



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