Package ‘genieBPC’

March 29, 2024

Type Package

Title Project GENIE BioPharma Collaborative Data Processing Pipeline

Version 1.1.1

Description The American Association Research (AACR) Project Genomics Evidence Neoplasia Information Exchange (GENIE) BioPharma Collaborative represents a multi-year, multi-institution effort to build a pan-cancer repository of linked clinico-genomic data. The genomic and clinical data are provided in multiple releases (separate releases for each cancer cohort with updates following data corrections), which are stored on the data sharing platform ‘Synapse’ <https://www.synapse.org/>.

The ‘genieBPC’ package provides a seamless way to obtain the data corresponding to each release from ‘Synapse’ and to prepare datasets for analysis.

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BugReports https://github.com/GENIE-BPC/genieBPC/issues

Depends R (>= 3.4)

Imports cli (>= 2.5.0), dplyr (>= 1.0.6), dtplyr (>= 1.1.0), htr, jsonlite, purr (>= 0.3.4), rlang (>= 1.0.0), stringr (>= 1.4.0), sunburstR, tibble (>= 3.1.2), tidyr

Suggests covr (>= 3.5.1), ggplot2 (>= 3.3.5), gt (>= 0.3.0), gtsummary (>= 1.5.2), knitr (>= 1.33), magrittr (>= 2.0.1), plotly (>= 4.10.0), rmarkdown (>= 2.8), testthat (>= 3.0.0), markdown, spelling

VignetteBuilder knitr

Config/testthat/edition 3

Encoding UTF-8

LazyData TRUE

RoxygenNote 7.2.3

URL https://genie-bpc.github.io/genieBPC/

Language en-US
check_genie_access

Description
Check Access to GENIE Data

Usage
check_genie_access(username = NULL, password = NULL)

Arguments
username
'Synapse’ username. If NULL, package will search package environment for "username". If not found, package will look in environmental variables for ‘SYNAPSE_USERNAME’.

password
'Synapse’ password. If NULL, package will search package environment for "password". If not found package will search environmental variables for ‘SYNAPSE_PASSWORD’.
create_analytic_cohort

Value

A success message if you are able to access GENIE BPC data; otherwise an error

Author(s)

Karissa Whiting

Examples

```r
## Not run:
# if credentials are saved:
check_genie_access()
## End(Not run)
```

create_analytic_cohort

*Select cohort of patients for analysis*

Description

This function allows the user to create a cohort from the GENIE BPC data based on cancer diagnosis information such as cancer cohort, treating institution, histology, and stage at diagnosis, as well as cancer-directed regimen information including regimen name and regimen order. This function returns each of the clinical and genomic data files subset on the patients that met criteria for the analytic cohort. Documentation regarding the structure and contents of each file can be found in the Analytic Data Guide corresponding to each data release, as well as in the Clinical Data Structure vignette.

Usage

```r
create_analytic_cohort(
  data_synapse,  
  index_ca_seq = 1,  
  institution,  
  stage_dx,  
  histology,  
  regimen_drugs,  
  regimen_type = "Exact",  
  regimen_order,  
  regimen_order_type,  
  return_summary = FALSE
)
```
create_analytic_cohort

Arguments

data_synapse
The item from the nested list returned from pull_data_synapse() that corre-
sponds to the cancer cohort of interest.

index_ca_seq
Index cancer sequence. Default is 1, indicating the patient’s first index cancer.
The index cancer is also referred to as the BPC Project cancer in the GENIE
BPC Analytic Data Guide; this is the cancer that met the eligibility criteria for
the project and was selected at random for PRISSMM phenomic data curation.
Specifying multiple index cancer sequences, e.g. index_ca_seq = c(1, 2) will
return index cancers to patients with 1 index cancer and will return the first
AND second index cancers to patients with multiple.

institution
GENIE BPC participating institution. Must be one of "DFCI", "MSK", "UHN",
or "VICC" for NSCLC, BLADDER, Prostate, and PANC cohorts; must be one
of "DFCI", "MSK", "VICC" for CRC and BrCa. Default selection is all insti-
tutions. This parameter corresponds to the variable ‘institution’ in the Analytic
Data Guide.

stage_dx
Stage at diagnosis. Must be one of "Stage I", "Stage II", "Stage III", "Stage I-III
NOS", "Stage IV". The default selection is all stages. Note that if this param-
eter is specified, any cases that are missing stage information are automatically
excluded from the resulting cohort. This parameter corresponds to the variable
‘stage_dx’ in the Analytic Data Guide.

histology
Cancer histology. For all cancer cohorts except for BrCa (breast cancer), this pa-
rameter corresponds to the variable ‘ca_hist_adeno_squamous’ and must be one
of "Adenocarcinoma", "Squamous cell", "Sarcoma", "Small cell carcinoma",
"Carcinoma", "Other histologies/mixed tumor". For BrCa, this parameter cor-
responds to the variable ‘ca_hist_brca’ and must be one of "Invasive lobular
carcinoma", "Invasive ductal carcinoma", "Other histology". The default selec-
tion is all histologies. Note that if this parameter is specified, any cases that
are missing histology information are automatically excluded from the resulting
cohort.

regimen_drugs
Vector with names of drugs in cancer-directed regimen, separated by a comma.
For example, to specify a regimen consisting of Carboplatin and Pemetrexed,
specify regimen_drugs = "Carboplatin, Pemetrexed". Acceptable values are
found in the ‘drug_regimen_list’ dataset provided with this package. This pa-
rameter corresponds to the variable ‘regimen_drugs’ in the Analytic Data Guide.

regimen_type
Indicates whether the regimen(s) specified in ‘regimen_drugs’ indicates the ex-
act regimen to return, or if regimens containing the drugs listed in ‘regimen_drugs’
should be returned. Must be one of "Exact" or "Containing". The default is "Ex-
act".

regimen_order
Order of cancer-directed regimen. If multiple drugs are specified, ‘regimen_order’
indicates the regimen order for all drugs; different values of ‘regimen_order’
cannot be specified for different drug regimens. If multiple values are specified,
e.g. c(1, 2), then drug regimens that met either order criteria are returned.

regimen_order_type
Specifies whether the ‘regimen_order’ parameter refers to the order of receipt
of the drug regimen within the cancer diagnosis (across all other drug regimens;
"within cancer") or the order of receipt of the drug regimen within the times that
that drug regimen was administered (e.g. the first time carboplatin pemetrexed was received, out of all times that the patient received carboplatin pemetrexed; "within regimen"). Acceptable values are "within cancer" and "within regimen".

return_summarySpecifies whether a summary table for the cohort is returned. Default is FALSE. The ‘gtsummary’ package is required to return a summary table.

Details
See the create_analytic_cohort vignette for further documentation and examples.

Value
A list of data frames containing clinical and next generation sequencing information for patients that met the specified criteria. Optionally, if return_summary = TRUE, the list also includes summary tables for the number of records per dataset (‘tbl_overall_summary’) as well as tables of key cancer diagnosis (‘tbl_cohort’), cancer-directed regimen (‘tbl_drugs’) and next generation sequencing (‘tbl_ngs’) variables.

Author(s)
Jessica Lavery

Examples
# Examples using package test data
# Example 1 ----------------------------------
# Create a cohort of all patients with stage IV NSCLC adenocarcinoma and
# obtain all of their corresponding clinical and genomic data

ex1 <- create_analytic_cohort(
  data_synapse = genieBPC::nsclc_test_data,
  stage_dx = "Stage IV",
  histology = "Adenocarcinoma"
)

names(ex1)

# Example 2 ----------------------------------
# Create a cohort of all NSCLC patients who received Cisplatin,
# Pemetrexed Disodium or Cisplatin, Etoposide as their first drug regimen
# for their first index NSCLC

ex2 <- create_analytic_cohort(
  data_synapse = genieBPC::nsclc_test_data,
  regimen_drugs = c("Cisplatin, Pemetrexed Disodium",
                    "Cisplatin, Etoposide"),
  regimen_order = 1,
  regimen_order_type = "within cancer"
)
# Example 3 ----------------------------------
# Create a cohort of all NSCLC patients who received Cisplatin, Pemetrexed Disodium at any time throughout the course of treatment for their cancer diagnosis, but in the event that the patient received the drug multiple times, only select the first time.

ex3 <- create_analytic_cohort(
  data_synapse = genieBPC::nsclc_test_data,
  regimen_drugs = c("Cisplatin, Pemetrexed Disodium"),
  regimen_order = 1,
  regimen_order_type = "within regimen"
)

# Example 4 ----------------------------------
# Using create_analytic_cohort with pull_data_synapse
nsclc_2_0 <- pull_data_synapse("NSCLC", version = "v2.0-public")

ex4 <- create_analytic_cohort(
  data_synapse = nsclc_2_0$NSCLC_v2.0,
  regimen_drugs = c("Cisplatin, Pemetrexed Disodium"),
  regimen_order = 1,
  regimen_order_type = "within regimen"
)

drug_regimen_list

## List of Drug Regimen Names by Cohort

### Description
A dataset containing the cancer-directed drug names and their synonyms.

### Usage
drug_regimen_list

### Format
A table for cancer-directed drug names associated with each cancer cohort:

- **cohort** GENIE BPC Project cancer. Must be one of "NSCLC" (non-small cell lung cancer), "CRC" (colorectal cancer), or "BrCa" (breast cancer). Future cohorts will include "PANC" (pancreatic cancer), "Prostate" (prostate cancer), and "BLADDER" (bladder cancer).

- **drug_name** Name of generic/ingredient cancer-directed drug

- **drug_name_full** Name of generic/ingredient cancer-directed drug with associated synonyms in parentheses ...
**drug_regimen_sunburst**  
*Visualize drug regimen sequences in a sunburst plot*

**Description**

This function allows the user to visualize the complete treatment course for selected cancer diagnoses.

**Usage**

```r
drug_regimen_sunburst(data_synapse, data_cohort, max_n_regimens = NULL, ...)
```

**Arguments**

- `data_synapse`  
  The item from the nested list returned from `pull_data_synapse()`

- `data_cohort`  
  The list returned from the `create_analytic_cohort()` function call

- `max_n_regimens`  
  The maximum number of regimens displayed in the sunburst plot

- `...`  
  Additional parameters passed to `sunburstR::sunburst()`

**Details**

See the **drug_regimen_sunburst vignette** for additional details and examples.

**Value**

Returns data frame `treatment_history` and interactive plot `sunburst_plot`

**Examples**

```r
# Example 1 ----------------------------------
# Example using package test data
# get clinico-genomic files for a specific cohort
nsclc_sub <- create_analytic_cohort(
  data_synapse = genieBPC::nsclc_test_data,
  stage_dx = c("Stage III", "Stage IV")
)

# create sunburst plot
ex1 <- drug_regimen_sunburst(
  data_synapse = nsclc_test_data,
  data_cohort = nsclc_sub,
  max_n_regimens = 3
)

# Example 2 ----------------------------------
# using pull_data_synapse
nsclc_2_0 <- pull_data_synapse("NSCLC", version = "v2.0-public")
```
nsclc_stg_iv <- create_analytic_cohort(
  data_synapse = nsclc_2_0$NSCLC_v2.0,
  stage = "Stage IV"
)

ex2 <- drug_regimen_sunburst(
  data_synapse = nsclc_2_0$NSCLC_v2.0,
  data_cohort = nsclc_stg_iv,
  max_n_regimens = 3
)

---

**genie_panels**  
*Genomic Panels Included in GENIE BPC Data*

**Description**

A dataset containing the name, assay identifier, and number of genes in each next-generation sequencing targeted panel included in GENIE BPC.

**Usage**

```
genie_panels
```

**Format**

A data frame with 12 rows and 3 variables:

- **Sequence.Assay.ID** Next-generation sequencing targeted panel assay identifier
- **Panel** Panel name
- **Genes** Number of genes included ...

---

**nsclc_test_data**  
*Simulated fake GENIE BPC data for function examples and tests*

**Description**

A named list of simulated NSCLC clinical and genomic data

**Usage**

```
nsclc_test_data
```
pull_data_synapse

Format

A list of data frames

- **pt_char**  Patient characteristic data.frame
- **ca_dx_index**  Index cancer diagnosis data.frame
- **ca_dx_non_index**  Non-index cancer diagnosis data.frame
- **ca_drugs**  Cancer directed-regimen data.frame
- **prissmm_imaging**  PRISSMM Imaging report data.frame
- **prissmm_pathology**  PRISSMM Pathology report data.frame
- **prissmm_md**  PRISSMM medical oncologist report data.frame
- **cpt**  Cancer Panel Test (CPT)/Next Generation Sequencing (NGS) data.frame
- **mutations_extended**  Mutations data.frame
- **fusions**  Fusions data.frame
- **cpt**  Copy Number Alteration (CNA) data.frame

Description

Function to access specified versions of clinical and genomic GENIE BPC data from Synapse and read them into the R environment. See the pull_data_synapse vignette for further documentation and examples.

Usage

```r
pull_data_synapse(
  cohort = NULL,
  version = NULL,
  download_location = NULL,
  username = NULL,
  password = NULL
)
```

Arguments

- **cohort**  Vector or list specifying the cohort(s) of interest. Must be one of "NSCLC" (Non-Small Cell Lung Cancer), "CRC" (Colorectal Cancer), or "BrCa" (Breast Cancer), "PANC" (Pancreatic Cancer), "Prostate" (Prostate Cancer), and "BLADDER" (Bladder Cancer).
version  Vector specifying the version of the cohort. Must match one of the release versions available for the specified ‘cohort’ (see ‘synapse_version()’ for available cohort versions). When entering multiple cohorts, it is inferred that the order of the version numbers passed corresponds to the order of the cohorts passed. Therefore, ‘cohort’ and ‘version’ must be in the same order to ensure the correct data versions are pulled. See examples below for details.

download_location  if ‘NULL’ (default), data will be returned as a list of dataframes with requested data as list items. Otherwise, specify a folder path to have data automatically downloaded there. When a path is specified, data are not read into the R environment.

username  ‘Synapse’ username
password  ‘Synapse’ password

Value
Returns a nested list of clinical and genomic data corresponding to the specified cohort(s).

Authentication
To access data, users must have a valid ‘Synapse’ account with permission to access the data set and they must have accepted any necessary ‘Terms of Use’. Users must always authenticate themselves in their current R session. (see README: Data Access and Authentication for details). To set your ‘Synapse’ credentials during each session, call:
`set_synapse_credentials(username = "your_username", password = "your_password")`
If your credentials are stored as environmental variables, you do not need to call ‘set_synapse_credentials()’ explicitly each session. To store authentication information in your environmental variables, add the following to your .Renviron file, then restart your R session’ (tip: you can use ‘usethis::edit_r_environ()’ to easily open/edit this file):

- ‘SYNAPSE_USERNAME = <your-username>’
- ‘SYNAPSE_PASSWORD = <your-password>’

Alternatively, you can pass your username and password to each individual data pull function if preferred, although it is recommended that you manage your passwords outside of your scripts for security purposes.

Analytic Data Guides
Documentation corresponding to the clinical data files can be found on ‘Synapse’ in the Analytic Data Guides:
- NSCLC v1.1-Consortium Analytic Data Guide
- NSCLC v2.2-Consortium Analytic Data Guide
- NSCLC v2.0-Public Analytic Data Guide
- CRC v1.3-Consortium Analytic Data Guide
- CRC v2.0-Public Analytic Data Guide
regimen_abbreviations

- BrCa v1.1-Consortium Analytic Data Guide
- BrCa v1.2-Consortium Analytic Data Guide
- BLADDER v1.1-Consortium Analytic Data Guide
- BLADDER v1.2-Consortium Analytic Data Guide
- PANC v1.1-Consortium Analytic Data Guide
- PANC v1.2-Consortium Analytic Data Guide
- Prostate v1.1-Consortium Analytic Data Guide
- Prostate v1.2-Consortium Analytic Data Guide

Author(s)

Karissa Whiting, Michael Curry

Examples

```r
# Example 1 ----------------------------------
# Set up 'Synapse' credentials
set_synapse_credentials()

# Print available versions of the data
synapse_version(most_recent = TRUE)

# Pull version 2.0-public for non-small cell lung cancer
# and version 2.0-public for colorectal cancer data
ex1 <- pull_data_synapse(
  cohort = c("NSCLC", "CRC"),
  version = c("v2.0-public", "v2.0-public")
)

names(ex1)
```

regimen_abbreviations  List of Drug Regimen Abbreviations

Description

A dataset containing the cancer-directed drug regimens and their common abbreviations

Usage

regimen_abbreviations
select_unique_nsg

Format

A table for cancer-directed drug regimens and their common abbreviations

- regimen_drugs: List of all drugs in the regimen
- abbreviation: Common name of drug regimen, e.g. FOLFOX...

select_unique_nsg

Selecting corresponding unique next generation sequencing reports

Description

For patients with multiple associated next generation (NGS) sequencing reports, select one unique NGS report per patient for the purpose of creating an analytic dataset based on user-defined criteria, including OncoTree code, primary vs. metastatic tumor sample, and earliest vs. most recent sample. If multiple reports for a patient remain available after the user-defined specifications, or if no specifications are provided, the panel with the largest number of genes is selected by default. Sample optimization is performed in the order that the arguments are specified in the function, regardless of the arguments’ order provided by the user. Namely, the OncoTree code is prioritized first, sample type is prioritized second and finally the time is prioritized last. For patients with exactly one genomic sample, that unique genomic sample will be returned regardless of whether it meets the user-specified parameters. Running the select_unique_nsg() function will ensure that the resulting dataset returned by merging the next generation sequencing report data onto the cohort_ca_dx dataset returned by create_analytic_cohort() will maintain the structure of cohort_ca_dx (either one record per patient or one record per diagnosis). Currently, if multiple diagnoses per patient are returned from create_analytic_cohort(), using select_unique_nsg() will select a single NGS report per patient. In future iterations, this will be updated so that one NGS report per diagnosis can be selected.

Usage

```r
select_unique_nsg(
  data_cohort,
  oncotree_code = NULL,
  sample_type = NULL,
  min_max_time = NULL
)
```

Arguments

- data_cohort: output object of the create_analytic_cohort function.
- oncotree_code: character vector specifying which sample OncoTree codes to keep. See "cpt_oncotree_code" column of data_cohort argument above to get options.
- sample_type: character specifying which type of genomic sample to prioritize, options are "Primary", "Local" and "Metastasis". Default is to not select a NGS sample based on the sample type.
- min_max_time: character specifying if the first or last genomic sample recorded should be kept. Options are "min" (first) and "max" (last).
**Details**

Note that the NGS dataset serves as the link between the clinical and genomic data, where the NGS dataset includes one record per NGS report per patient, including the NGS sample ID that is used to link to the genomic data files. Merging data from the NGS report onto the analytic cohort returned from `create_analytic_cohort()` therefore allows users to utilize all clinical and genomic data available.

See the `select_unique_ngs` vignette for further documentation and examples.

**Value**

returns the 'cohort_ngs' object of the `create_analytic_cohort` with unique genomic samples taken from each patients.

**Author(s)**

Karissa Whiting

**Examples**

```r
# Example 1 ----------------------------------
# Create a cohort of all patients with stage IV NSCLC of
# histology adenocarcinoma
nsclc_2_0 <- pull_data_synapse("NSCLC", version = "v2.0-public")

ex1 <- create_analytic_cohort(
data_synapse = nsclc_2_0$NSCLC_v2.0,
    stage_dx = c("Stage IV"),
    histology = "Adenocarcinoma"
)

# select unique next generation sequencing reports for those patients
samples_data1 <- select_unique_ngs(
data_cohort = ex1$cohort_ngs,
    sample_type = "Primary"
)

# Example 2 ----------------------------------
# Create a cohort of all NSCLC patients who
# received Cisplatin, Pemetrexed Disodium or Cisplatin,
# Etoposide as their first drug regimen
ex2 <- create_analytic_cohort(
data_synapse = nsclc_2_0$NSCLC_v2.0,
    regimen_drugs = c("Cisplatin, Pemetrexed Disodium",
       "Cisplatin, Etoposide"),
    regimen_order = 1,
    regimen_order_type = "within regimen"
)
```
samples_data2 <- select_unique_ngs(
  data_cohort = ex2$cohort_ngs,
  oncotree_code = "NSCLCPD",
  sample_type = "Metastasis",
  min_max_time = "max"
)

set_synapse_credentials

Connect to 'Synapse' API

Description

This function sets 'Synapse' credentials for the user's current session.

Usage

set_synapse_credentials(username = NULL, password = NULL)

Arguments

username 'Synapse' username. If NULL, package will search environmental variables for 'SYNAPSE_USERNAME'.

password 'Synapse' password. If NULL, package will search environmental variables for 'SYNAPSE_PASSWORD'.

Details

To access data, users must have a valid 'Synapse' account with permission to access the data set and they must have accepted any necessary 'Terms of Use'. Users must authenticate themselves in their current R session. (See README 'Data Access and Authentication' at https://genie-bpc.github.io/genieBPC/ for details). To set your 'Synapse' credentials during each session, call: 'set_synapse_credentials(username = "your_username", password = "your_password")'.

If your credentials are stored as environmental variables, you do not need to call 'set_synapse_credentials()' explicitly each session. To store authentication information in your environmental variables, add the following to your .Renviron file, then restart your R session (tip: you can use 'usethis::edit_r_environ()' to easily open/edit this file):

- 'SYNAPSE_USERNAME = <your-username>'
- 'SYNAPSE_PASSWORD = <your-password>'

Alternatively, you can pass your username and password to each individual data pull function if preferred, although it is recommended that you manage your passwords outside of your scripts for security purposes.
Value

A success message if you credentials are valid for 'Synapse' platform; otherwise an error

Author(s)

Karissa Whiting

Examples

```r
## Not run:
set_synapse_credentials(
  username = "your-username",
  password = "your-password"
)

## End(Not run)
```

---

<table>
<thead>
<tr>
<th>synapse_tables</th>
<th>'Synapse’ table IDs</th>
</tr>
</thead>
</table>

Description

A dataset containing the 'Synapse' table IDs for each dataset in GENIE BPC.

Usage

```
synapse_tables
```

Format

A lookup table for 'Synapse' data table IDs:

- **cohort** GENIE BPC Project Cohort
- **version** Release version
- **release_date** Month and year of data release
- **df** Clinical, Genomic, or Metadata Dataset
- **synapse_id** 'Synapse’ table ID for each dataset ...

Source

Description

GENIE BPC data are updated periodically to add variables and reflect additional data cleaning. Each time the data are updated the data release version number is incremented. The 'synapse_version()' function will get available version numbers for each cohort to help the user determine what is the most recent version for each cohort.

Usage

`synapse_version(cohort = NULL, most_recent = FALSE)`

Arguments

- `cohort` Vector specifying the cohort(s) of interest. Cohorts must be one of "NSCLC" (Non-Small Cell Lung Cancer), "CRC" (Colorectal Cancer), or "BrCa" (Breast Cancer), "PANC" (Pancreatic Cancer), "Prostate" (Prostate Cancer), and "BLADDER" (Bladder Cancer).
- `most_recent` Indicates whether the function will return only the most recent version number for each cohort ('most_recent' = TRUE) or all available version numbers for each cohort ('most_recent' = FALSE)

Details

Specifies the version numbers available for each cancer cohort. Version numbers are specified as part of the call to `pull_data_synapse()`.

Value

Returns a table containing the available versions for each cohort. Consortium releases are restricted to GENIE BPC consortium members.

Examples

```r
synapse_version()
synapse_version(most_recent = TRUE)
```
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