

# Package ‘AnVILAz’

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**Title** R / Bioconductor Support for the AnVIL Azure Platform

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**Description** The AnVIL is a cloud computing resource developed in part by the National Human Genome Research Institute. The AnVILAz package supports end-users and developers using the AnVIL platform in the Azure cloud. The package provides a programmatic interface to AnVIL resources, including workspaces, notebooks, tables, and workflows. The package also provides utilities for managing resources, including copying files to and from Azure Blob Storage, and creating shared access signatures (SAS) for secure access to Azure resources.

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|                 |   |
|-----------------|---|
| AnVILAz-package | <i>AnVILAz: R / Bioconductor Support for the AnVIL Azure Platform</i> |
|-----------------|---|

---

## Description

The AnVIL is a cloud computing resource developed in part by the National Human Genome Research Institute. The AnVILAz package supports end-users and developers using the AnVIL platform in the Azure cloud. The package provides a programmatic interface to AnVIL resources, including workspaces, notebooks, tables, and workflows. The package also provides utilities for managing resources, including copying files to and from Azure Blob Storage, and creating shared access signatures (SAS) for secure access to Azure resources.

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## See Also

Useful links:

- <https://github.com/Bioconductor/AnVILAz>
- Report bugs at <https://github.com/Bioconductor/AnVILAz/issues>

## Description

avnotebooks() lists the notebooks in the current workspace.

## Usage

```
## S4 method for signature 'azure'
avnotebooks(local = FALSE, ..., platform = cloud_platform())

## S4 method for signature 'azure'
avnotebooks_localize(
  destination = "./analyses",
  dry = TRUE,
  ...,
  platform = cloud_platform()
)

## S4 method for signature 'azure'
avnotebooks_delocalize(
  source = "./",
  dry = TRUE,
  ...,
  platform = cloud_platform()
)
```

## Arguments

|             |  |
|-------------|--|
| local       | logical(1) notebooks located on the workspace (local = FALSE, default) or runtime / local instance (local = TRUE). When local = TRUE, the notebook path is <workspace_data_service_url()/analyses.                           |
| ...         | Additional arguments passed to lower level functions (not used)  |
| platform    | azure() The cloud platform class to dispatch on as given by <a href="#">AnVILBase::cloud_platform</a> . Typically not set manually as cloud_platform() returns the "azure" class for Azure workspaces on AnVIL.              |
| destination | character(1) or missing file path to the local file system directory for synchronization. The default location is ~/<workspace_data_service_url()/analyses. Out-of-date local files are replaced with the workspace version. |
| dry         | logical(1) Whether to perform a dry run i.e., add the --dry-run flag to the command.   |
| source      | character(1) or missing file path to the local file system directory for synchronization. The default location is the home folder. Out-of-date local files are replaced with the workspace version.                          |

## Value

avnotebooks() returns a character vector of files located in the workspace 'analyses/' folder path, or on the local file system.

**Functions**

- `avnotebooks(azure)`: List the notebooks in the current workspace
- `avnotebooks_localize(azure)`: Sync notebooks between the Azure Blob Storage Container and the local runtime
- `avnotebooks_delocalize(azure)`: Sync notebooks between the local runtime and the Azure Blob Storage Container

**Examples**

```
if (has_avworkspace(strict = TRUE, platform = azure()))
  avnotebooks()
```

---

 avtable-methods

*AnVIL Azure table ("type") methods*


---

**Description**

Methods for working with AnVIL Azure tables. These are referred to as "types" in the AnVIL Workspace Data Service (WDS) API.

**Usage**

```
## S4 method for signature 'azure'
avtable(table, ..., platform = cloud_platform())

## S4 method for signature 'azure'
avtables(..., platform = cloud_platform())

## S4 method for signature 'azure'
avtable_import(
  .data,
  table,
  entity = names(.data)[[1L]],
  ...,
  platform = cloud_platform()
)

## S4 method for signature 'azure'
avtable_import_set(
  .data,
  origin,
  set = names(.data)[[1]],
  member = names(.data)[[2]],
  ...,
  platform = cloud_platform()
)

## S4 method for signature 'azure'
avtable_delete(table, ..., platform = cloud_platform())
```

```
## S4 method for signature 'azure'
avtable_delete_values(table, values, ..., platform = cloud_platform())
```

### Arguments

|          |  |
|----------|--|
| table    | character(1) The name of the table / type  |
| ...      | Additional arguments passed to lower level functions (not used)  |
| platform | azure() The cloud platform class to dispatch on as given by <a href="#">AnVILBase::cloud_platform</a> . Typically not set manually as cloud_platform() returns the "azure" class for Azure workspaces on AnVIL.      |
| .data    | tibble() The dataset chiefly from the avtable() operation  |
| entity   | The entity name, i.e., the name of the column in the table that provides the keys for the data (a.k.a. primaryKey). By default, the first column in the table. The keys cannot contain special characters or spaces. |
| origin   | character(1) name of the type (entity table) used to create the set e.g "sample", "participant", etc.  |
| set      | character(1) column name of .data identifying the set(s) to be created, i.e., the grouping variable.   |
| member   | character(1) column name of .data identifying the member(s) of the set(s) or groups. The values in this column may repeat if an ID is in more than one set.  |
| values   | character() vector of primaryKey values corresponding to rows to be deleted  |

### Details

avtable\_import\_set() creates new rows in a table <origin>\_set. One row will be created for each distinct value in the column identified by set. Each row entry has a corresponding column <origin> linking to one or more rows in the <origin> table, as given in the member column. The operation is somewhat like split(member, set).

### Value

avtable: a tibble() corresponding to the data with the name as given by table  
 avtables: a tibble() with columns table, count, and colnames corresponding to the tables / types available in the current workspace  
 avtable\_import(): called for the side effect of uploading the data to the DATA tab  
 avtable\_import\_set(): a character(1) name of the imported tibble.  
 avtable\_delete: a logical(1) indicating success or failure  
 avtable\_delete\_values(): a logical(1) vector indicating success or failure for each value in values

### Functions

- avtable(azure): List the contents of a particular table / type
- avtables(azure): List the available tables / types
- avtable\_import(azure): Upload a dataset to the DATA tab
- avtable\_import\_set(azure): Create a grouping table from an origin dataset
- avtable\_delete(azure): Delete a table / type
- avtable\_delete\_values(azure): Delete rows from a table / type

**Examples**

```

if (interactive()) {
  library(dplyr)
  mtcars_tbl <-
    mtcars |>
    as_tibble(rownames = "model_id") |>
    mutate(model_id = gsub(" ", "-", model_id))

  avtable_import(
    mtcars_tbl,
    table = "testData",
    entity = "model_id"
  )

  avtable("testData")

  avtable("testData") |> # new 'testData_set' table
    avtable_import_set("testData", "cyl", "model_id")

  avtable_delete("testData_set")

  avtable_delete_values("testData", "Mazda-RX4")
}

```

---

avworkflow-methods      *Azure Workflow methods*

---

**Description**

avworkflow\_jobs() reports the status of workflow executions in the current workspace.

**Usage**

```

## S4 method for signature 'azure'
avworkflow_jobs(..., platform = cloud_platform())

avworkflow_jobs_inputs()

```

**Arguments**

|          |   |
|----------|---|
| ...      | Additional arguments passed to lower level functions (not used)   |
| platform | azure() The cloud platform class to dispatch on as given by <a href="#">AnVILBase::cloud_platform</a> . Typically not set manually as cloud_platform() returns the "azure" class for Azure workspaces on AnVIL. |

**Details**

The avworkflow\_jobs\_inputs() function returns the input parameters for the workflow jobs as a tibble.

**Value**

avworkflow\_jobs() returns a tibble with the status of the jobs in the current workspace.

**Functions**

- `avworkflow_jobs(azure)`: List the status of workflow jobs

**Examples**

```
if (has_avworkspace(strict = TRUE, platform = azure()))
  ## from within AnVIL
  avworkflow_jobs()
```

---

avworkspace-methods    *AnVIL Azure Workspace methods*

---

**Description**

AnVIL Azure Workspace methods

**Usage**

```
## S4 method for signature 'azure'
avworkspaces(..., platform = cloud_platform())

## S4 method for signature 'azure'
avworkspace_namespace(..., platform = cloud_platform())

## S4 method for signature 'azure'
avworkspace_name(..., platform = cloud_platform())

## S4 method for signature 'azure'
avworkspace(..., platform = cloud_platform())

## S4 method for signature 'azure'
avworkspace_clone(
  namespace = avworkspace_namespace(),
  name = avworkspace_name(),
  to_namespace = namespace,
  to_name,
  bucket_location = "US",
  ...,
  platform = cloud_platform()
)
```

**Arguments**

|                        |  |
|------------------------|--|
| <code>...</code>       | Additional arguments passed to lower level functions (not used)  |
| <code>platform</code>  | <code>azure()</code> The cloud platform class to dispatch on as given by <code>AnVILBase::cloud_platform</code> . Typically not set manually as <code>cloud_platform()</code> returns the "azure" class for Azure workspaces on AnVIL. |
| <code>namespace</code> | character(1) AnVIL workspace namespace as returned by, e.g., <code>avworkspace_namespace()</code>  |
| <code>name</code>      | character(1) AnVIL workspace name as returned by, e.g., <code>avworkspace_name()</code> .  |

to\_namespace character(1) workspace (billing account) in which to make the clone.  
 to\_name character(1) name of the cloned workspace.  
 bucket\_location character(1) region in which bucket attached to the workspace should be created. The default is set to a single region ("US"); multi-region is available but more costly.

### Value

avworkspaces(): a tibble table of available workspaces  
 avworkspace\_namespace(): a character string of the workspace namespace  
 avworkspace\_name(): a character string of the workspace name  
 avworkspace(): a character string of the workspace namespace and name combination  
 avworkspace\_clone(): called for the side-effect of cloning a workspace to a new namespace and name.

### Functions

- avworkspaces(azure): List workspaces
- avworkspace\_namespace(azure): List the workspace namespace
- avworkspace\_name(azure): Obtain the workspace name
- avworkspace(azure): Obtain the current workspace namespace and name combination
- avworkspace\_clone(azure): Clone a workspace

---

az-utilities

*az health check helpers*

---

### Description

These functions provide checks for essential workspace tools and variables. `az_exists` checks for the presence of the az command line utility. `az_healthcheck` checks for the presence of the az command line as well as the essential environment variables.

### Usage

```
az_exists()

az_health_check()
```

### Value

`az_exists` returns a logical value indicating the presence of the az command line utility. `az_healthcheck` returns a logical value indicating the presence of the az command line utility and the essential environment variables.

### Examples

```
if (interactive()) {
  az_exists()
  az_healthcheck()
}
```



---

|             |                             |
|-------------|-----------------------------|
| azure-class | <i>Azure platform class</i> |
|-------------|-----------------------------|

---

**Description**

This class represents the Azure platform.

**Usage**

```
azure()
```

**Examples**

```
az <- azure()
az
showClass(class(az))
```

---

|               |  |
|---------------|--|
| azure-methods | <i>A number of methods compatible with the Azure platform class.</i> |
|---------------|--|

---

**Description**

A number of methods compatible with the Azure platform class.

**Usage**

```
## S4 method for signature 'azure'
avcopy(source, destination, dry = TRUE, ..., platform = cloud_platform())

## S4 method for signature 'azure'
avlist(..., platform = cloud_platform())

## S4 method for signature 'azure'
avremove(source, recursive = FALSE, ..., platform = cloud_platform())

## S4 method for signature 'azure'
avbackup(
  source,
  destination,
  recursive = TRUE,
  ...,
  platform = cloud_platform()
)

## S4 method for signature 'azure'
avrestore(
  source,
  destination,
  recursive = TRUE,
  ...,
```

```

    platform = cloud_platform()
  )

  ## S4 method for signature 'azure'
  avstorage(..., platform = cloud_platform())

```

### Arguments

|             |   |
|-------------|---|
| source      | character(1) A relative file path corresponding to either the remote (az_copy_from_storage) or local (az_copy_to_storage) file location. Remote locations should be relative to the base directory in the Azure Storage Container e.g., analyses/jupyter.log.   |
| destination | character(1) A relative file path corresponding to either the remote (az_copy_to_storage) or local (az_copy_from_storage) file location. Remote locations should be relative to the base directory in the Azure Storage Container. When not specified, it will default to the base directory of the remote location. The to path can be a folder path but must end in a forward slash (/). If the to path points to a non-existent directory, it will be created. |
| dry         | logical(1) Whether to perform a dry run i.e., add the --dry-run flag to the command.  |
| ...         | Additional arguments passed to lower level functions (not used)   |
| platform    | azure() The cloud platform class to dispatch on as given by <code>AnVILBase::cloud_platform</code> . Typically not set manually as <code>cloud_platform()</code> returns the "azure" class for Azure workspaces on AnVIL.   |
| recursive   | logical(1) Whether to recursively move or remove files in a directory. Only applies to <code>avremove</code> , <code>avbackup</code> , and <code>avrestore</code> . Default is TRUE for backup and restore operations and FALSE for <code>avremove</code> .   |

### Details

The recursive argument for `avbackup` and `avrestore` is set to TRUE by default and FALSE for `avremove`. Note that wildcards are not supported for local or remote paths.

### Value

- `avlist` - a tibble of files and metadata
- `avcopy` - called for the side effect of copying a file **to** or **from** the Azure Storage Container depending on the source and destination inputs
- `avremove` - called for the side effect of removing a file or folder
- `avbackup` - called for the side effect of copying a directory **to** the Azure Storage Container
- `avrestore` - called for the side effect of copying a directory **from** the Azure Storage Container
- `avstorage` - a URL string of the Azure Storage Container location
- `avworkspaces` - a tibble of workspaces on AnVIL
- `avtable_import` - a response list indicating successful upload
- `avtable_delete_values` - when successful, a NULL value

## Functions

- `avcopy(azure)`: a generalized interface for either `az_copy_from_storage` or `az_copy_to_storage`; deduced from the source and destination inputs
- `avlist(azure)`: list all the files in the Azure Storage Container
- `avremove(azure)`: remove a file or directory from the Azure Storage
- `avbackup(azure)`: copy a directory from the workspace environment to the Azure Storage Container
- `avrestore(azure)`: copy a file or directory from the Azure Storage Container to the workspace environment
- `avstorage(azure)`: The base URI string used to move data to and from the Azure Storage Container

## Examples

```
if (interactive()) {  
  
  avlist()  
  
  ## local -> remote  
  ## using general interface avcopy  
  avcopy("jupyter.log", "analyses/jupyter.log")  
  
  ## upload a directory  
  avbackup("./test/", "analyses/test/")  
  
  ## using general interface az_copy  
  avcopy("analyses/jupyter.log", "./jupyter.log")  
  
  ## download a directory  
  avrestore("analyses/test/", "./test/")  
  
  avremove("analyses/jupyter.log")  
  
}
```

---

az\_copy-helpers

*Azure Copy command line utility helpers*

---

## Description

These functions invoke the `azcopy` command line utility. The utilities make use of a managed SAS token to mainly transfer files from the Azure workspace to the Azure Storage container. See `az_sas_token` for credential details. The results of `azcopy copy` commands are returned as an `azcopyStatus` object which has S3 methods to print and convert to logical.

## Usage

```
az_copy_from_storage(from, to = "./", recursive = FALSE, dry = TRUE)
```

```
az_copy_to_storage(from, to, recursive = FALSE, dry = TRUE)
```

```

## S3 method for class 'azcopyStatus'
as.logical(x, ...)

## S3 method for class 'azcopyStatus'
print(x, ..., verbose = FALSE)

## S3 method for class 'azcopyStatus'
summary(object, ...)

```

### Arguments

|           |   |
|-----------|---|
| from      | character(1) A relative file path corresponding to either the remote (az_copy_from_storage) or local (az_copy_to_storage) file location. Remote locations should be relative to the base directory in the Azure Storage Container e.g., analyses/jupyter.log.   |
| to        | character(1) A relative file path corresponding to either the remote (az_copy_to_storage) or local (az_copy_from_storage) file location. Remote locations should be relative to the base directory in the Azure Storage Container. When not specified, it will default to the base directory of the remote location. The to path can be a folder path but must end in a forward slash (/). If the to path points to a non-existent directory, it will be created. |
| recursive | logical(1) Whether to recursively move or remove files in a directory. Only applies to avremove, avbackup, and avrestore. Default is TRUE for backup and restore operations and FALSE for avremove.   |
| dry       | logical(1) Whether to perform a dry run i.e., add the --dry-run flag to the command.  |
| x         | azcopyStatus object to be checked; usually the output of avcopy operations  |
| ...       | Additional arguments (not used).  |
| verbose   | logical(1) Print the INFO lines from the azcopy output  |
| object    | azcopyStatus object to be summarized; usually the output of avcopy operations   |

### Details

- az\_copy\_from\_storage - copy a file from the Azure Storage Container to the workspace environment
- az\_copy\_to\_storage - copy a file from the workspace environment to the Azure Storage Container

### Value

- az\_copy\_from\_storage - called for the side effect of copying a file **from** the Azure Storage Container
- az\_copy\_to\_storage - called for the side effect of copying a file **to** the Azure Storage Container

### Functions

- as.logical(azcopyStatus): Convert results of azcopy operations to logical values
- print(azcopyStatus): Print the results of azcopy operations
- summary(azcopyStatus): Get a summary of the results of azcopy operations

## Examples

```
if (interactive()) {  
  
  ## local -> remote  
  az_copy_to_storage("jupyter.log", "analyses/jupyter.log")  
  az_copy_to_storage("jupyter.log", "analyses/test/")  
  
  ## placed in the base storage UUID directory  
  az_copy_to_storage("jupyter.log")  
  
  ## remote -> local  
  az_copy_from_storage("analyses/jupyter.log", "jupyter.log")  
  ## download to the current directory  
  az_copy_from_storage("analyses/jupyter.log")  
  
}
```

---

az\_sas\_token

*Obtain the Shared Access Signature (SAS) for the Azure Storage*

---

## Description

The function provides a user delegation SAS token for management of resources. Mainly used in other functions to move files to and from the Azure Storage Container

## Usage

```
az_sas_token(sasExpirationDuration = 28800)
```

## Arguments

sasExpirationDuration  
numeric(1) The number of seconds until the SAS token expires (default: 28,800 seconds)

## Value

A list of two elements named token and url

## Examples

```
if (interactive()) {  
  sas <- az_sas_token()  
  sas[["token"]]  
  sas[["url"]]  
}
```

---

|          |  |
|----------|--|
| az_token | <i>Generate an Azure authentication token with the az command line utility</i> |
|----------|--|

---

### Description

This function generates an Azure authentication token with the az command line utility. The token is used to authenticate with the Azure services. This function is called internally by the az\_\* functions. It is not meant to be called directly.

### Usage

```
az_token()
```

### Value

A character string containing the authentication token with a "Bearer" prefix.

---

|                         |  |
|-------------------------|--|
| has_avworkspace-methods | <i>Helper to check if the current environment is within an Azure workspace</i> |
|-------------------------|--|

---

### Description

has\_avworkspace() checks that the AnVIL environment is set up to work with Azure. If strict = TRUE, it also checks that the workspace name is set.

### Usage

```
## S4 method for signature 'azure'
has_avworkspace(strict = FALSE, ..., platform = cloud_platform())
```

### Arguments

|          |   |
|----------|---|
| strict   | logical(1) Whether to include a check for an existing avworkspace_name() setting. Default FALSE.            |
| ...      | Arguments passed to the methods.  |
| platform | A Platform derived class indicating the AnVIL environment, currently, azure and gcp classes are compatible. |

### Value

logical(1) TRUE if the AnVIL environment is set up properly to interact with Azure, otherwise FALSE.

### Functions

- has\_avworkspace(azure): Check if the AnVIL environment is set up

**Examples**

```
has_avworkspace(platform = azure())
```

---

workspace-dev-ops      *Functions to work with workspace data for developers*

---

**Description**

These group of functions will allow you to manipulate tables in the "DATA" tab. Example operations include moving a flat Tab-Separated Values (TSV) file into the workspace, deleting records, deleting tables, adding a single row, retrieving a single row, and retrieving the data table. Note that the API used refers to tables as types.

**Usage**

```
upload_tsv(
  tsv_file,
  type = tools::file_path_sans_ext(basename(tsv_file)),
  primaryKey = NULL
)

download_tsv(type)

delete_type_id(type, id)

add_type_id(row, type, id = row[[1L]])

get_type_id(type, id)

delete_type(type)
```

**Arguments**

|            |   |
|------------|---|
| tsv_file   | character(1) A path to a tab-separated values file  |
| type       | character(1) A nickname for the uploaded dataset important for retrieval. By default, the file name will be used.   |
| primaryKey | character(1) The optional column name to uniquely identify a record. By default, the first column is used as the primary key and all values in the column must be unique. |
| id         | character(1) The value in the primaryKey column that indicates the row to be removed.   |
| row        | tibble() or data.frame() A single row to add to an existing table. The row must have the same column names as the table. The primaryKey column must be unique.            |

## Details

These functions use the Workspace Data Services (WDS) API. Current operations that affect the "DATA" tab include:

- `upload_tsv` - a POST request using a TSV file that populates the data
- `download_tsv` - a GET request with the data name (type argument) in `upload_tsv` to represent the data locally as a tibble
- `delete_type_id` - a DELETE request to remove a record or row from type
- `add_type_id` - a PUT request to add a single row to an existing table (type)
- `get_type_id` - a GET request to retrieve a single row from an existing table (type)
- `delete_type` - a DELETE request to remove then entire data set (type)

## Value

- `upload_tsv` - A response list indicating successful upload
- `download_tsv` - A tibble corresponding to the data labeled with type
- `delete_type_id`; `delete_type` - When successful, a NULL value

## Examples

```
if (interactive()) {
  library(dplyr)
  type <- "model"
  mtcars_tbl <-
    mtcars |>
    as_tibble(rownames = "model_id") |>
    mutate(model_id = gsub(" ", "-", model_id))

  tsv_file <- tempfile()
  readr::write_tsv(mtcars_tbl, tsv_file)
  upload_tsv(
    tsv_file = tsv_file,
    type = "testData",
    primaryKey = "model_id"
  )

  download_tsv("testData")

  ## create an example single row tibble for add_type_id
  datsun <- filter(mtcars_tbl, model_id == "Datsun-710")
  ## change the model_id to be unique
  datsun[["model_id"]] <- "Datsun-512"

  add_type_id(row = datsun, type = "testData")

  get_type_id("testData", "Datsun-512")

  delete_type_id("testData", "Datsun-512")

  delete_type("testData")
}
```



---

`workspace-env`*Access Terra on Azure workspace session variables*

---

## Description

A group of functions that return environment variables in the Terra Azure workspace. The Workspace Data Service URL sends out an API GET request to obtain the data services URL for uploading data to the workspace "DATA" tab.

## Usage

```
workspace_id()

workspace_storage_cont_id()

workspace_storage_cont_url()

wds_api_version()

workspace_data_service_url()

cbas_url()
```

## Value

- `workspace_id` - A UUID string referring to "workspaceId" or "workspaceid" in API calls
- `workspace_storage_cont_id` - A UUID string identifying the resource storage container owned by the user account, a.k.a. "resourceId"
- `workspace_storage_cont_url` - The base URI string used to move data to and from the Azure Storage Container
- `wds_api_version` - The version of the Workspace Data Service API, defaults to "v0.2"
- `workspace_data_service_url` - The base URI string used to move data to to and from the workspace "DATA" tab
- `cbas_url` - The base URI string used to query the workflow submission history

## Examples

```
workspace_id()
workspace_storage_cont_id()
workspace_storage_cont_url()
if (interactive()) {
  workspace_data_service_url()
  cbas_url()
}
```

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