

Package ‘rang’

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Title Reconstructing Reproducible R Computational Environments

Version 0.3.0

Description Resolve the dependency graph of R packages at a specific time point based on the information from various 'R-hub' web services <<https://blog.r-hub.io/>>. The dependency graph can then be used to reconstruct the R computational environment with 'Rocker' <<https://rocker-project.org>>.

License GPL (>= 3)

Encoding UTF-8

RoxygenNote 7.2.3

URL <https://github.com/gesistsa/rang>

BugReports <https://github.com/gesistsa/rang/issues>

Suggests knitr, rmarkdown, testthat (>= 3.0.0)

Config/testthat/edition 3

Imports parsedate, fastmap, jsonlite, memoise, pkgsearch, remotes,
utils, httr, vctrs, renv, here

Depends R (>= 3.5.0)

VignetteBuilder knitr

LazyData true

NeedsCompilation no

Author Chung-hong Chan [aut, cre] (<<https://orcid.org/0000-0002-6232-7530>>),
David Schoch [aut] (<<https://orcid.org/0000-0003-2952-4812>>),
Egor Kotov [ctb] (<<https://orcid.org/0000-0001-6690-5345>>)

Maintainer Chung-hong Chan <chainsawtiney@gmail.com>

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apptainerize	<i>Create an Apptainer/Singularity Definition File of The Resolved Result</i>
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Description

This function exports the result from `resolve()` to an Apptainer/Singularity definition file. For R version $\geq 3.1.0$, the file is based on the versioned Rocker Docker image. For R version $< 3.1.0$, the Apptainer/Singularity definition is based on Debian and it compiles R from source.

Usage

```
apptainerize(
  rang,
  output_dir,
  materials_dir = NULL,
  post_installation_steps = NULL,
  image = c("r-ver", "rstudio", "tidyverse", "verse", "geospatial"),
  rang_as_comment = TRUE,
  cache = FALSE,
  verbose = TRUE,
  lib = NA,
  cran_mirror = "https://cran.r-project.org/",
  check_cran_mirror = TRUE,
  bioc_mirror = "https://bioconductor.org/packages/",
  no_rocker = FALSE,
  debian_version = c("lenny", "squeeze", "wheezy", "jessie", "stretch"),
  skip_r17 = TRUE,
  insert_readme = TRUE,
  copy_all = FALSE
)
```

apptainerize_rang(...)

apptainerise(...)

apptainerise_rang(...)

singularize(...)

singularize_rang(...)

singularise(...)

singularise_rang(...)

Arguments

rang	output from <code>resolve()</code>
output_dir	character, where to put the Apptainer/Singularity definition file and associated content
materials_dir	character, path to the directory containing additional resources (e.g. analysis scripts) to be copied into <code>output_dir</code> and in turn into the Apptainer/Singularity container
post_installation_steps	character, additional steps to be added before the in the end of <code>%post</code> section the Apptainer/Singularity definition file, see an example below
image	character, which versioned Rocker image to use. Can only be "r-ver", "rstudio", "tidyverse", "verse", "geospatial" This applies only to R version ≥ 3.1
rang_as_comment	logical, whether to write resolved result and the steps to reproduce the file to path as comment
cache	logical, whether to cache the packages now. Please note that the system requirements are not cached. For query with non-CRAN packages, this option is strongly recommended. For query with local packages, this must be TRUE regardless of R version. For R version < 3.1 , this must be also TRUE if there is any non-CRAN packages.
verbose	logical, pass to <code>install.packages()</code> , the negated value is also passed as quiet to both <code>install.packages()</code> and <code>download.file()</code> .
lib	character, pass to <code>install.packages()</code> . By default, it is NA (to install the packages to the default location)
cran_mirror	character, which CRAN mirror to use
check_cran_mirror	logical, whether to check the CRAN mirror
bioc_mirror	character, which Bioconductor mirror to use
no_rocker	logical, whether to skip using Rocker images even when an appropriate version is available. Please keep this as TRUE unless you know what you are doing

debian_version	when Rocker images are not used, which EOL version of Debian to use. Can only be "lenny", "etch", "squeeze", "wheezy", "jessie", "stretch". Please keep this as default "lenny" unless you know what you are doing
skip_r17	logical, whether to skip R 1.7.x. Currently, it is not possible to compile R 1.7.x (R 1.7.0 and R 1.7.1) with the method provided by rang. It affects snapshot_date from 2003-04-16 to 2003-10-07. When skip_r17 is TRUE and snapshot_date is within the aforementioned range, R 1.8.0 is used instead
insert_readme	logical, whether to insert a README file
copy_all	logical, whether to copy everything in the current directory into the container. If inst/rang is detected in output_dir, this is coerced to TRUE.
...	arguments to be passed to apptainerize

Details

The idea behind this is to determine the installation order of R packages locally. Then, the installation script can be deployed to another fresh R session to install R packages. `dockerize()` and `apptainerize()` are more reasonable ways because a fresh R session with all system requirements is provided. The current approach does not work in R < 2.1.0.

Value

output_dir, invisibly

References

Apptainer / Singularity

Kurtzer, G. M., Sochat, V., & Bauer, M. W. (2017) Singularity: Scientific containers for mobility of compute. PLOS ONE, 12(5):e0177459. doi:10.1371/journal.pone.0177459

The Rocker Project

Ripley, B. (2005) Packages and their Management in R 2.1.0. R News, 5(1):8–11.

See Also

`resolve()`, `export_rang()`, `use_rang()`

Examples

```
if (interactive()) {
  graph <- resolve(
    pkgs = c("openNLP", "LDavis", "topicmodels", "quanteda"),
    snapshot_date = "2020-01-16"
  )
  apptainerize(graph, ".")
  ## An example of using post_installation_steps to install quarto
  install_quarto <- c("apt-get install -y curl git && \\\
curl -LO https://quarto.org/download/latest/quarto-linux-amd64.deb && \\\
dpkg -i quarto-linux-amd64.deb && \\\
```

```

    quarto install tool tinytex")
  aptainerize(graph, ".", post_installation_steps = install_quarto)
}

```

as_pkgrefs

Convert Data Structures into Package References

Description

This generic function converts several standard data structures into a vector of package references, which in turn can be used as the first argument of the function [resolve\(\)](#). This function guesses the possible sources of the packages. But we strongly recommend manually reviewing the detected packages before using them for [resolve\(\)](#).

Usage

```

as_pkgrefs(x, ...)

## Default S3 method:
as_pkgrefs(x, ...)

## S3 method for class 'character'
as_pkgrefs(x, bioc_version = NULL, no_enhances = TRUE, no_suggests = TRUE, ...)

## S3 method for class 'sessionInfo'
as_pkgrefs(x, ...)

```

Arguments

x,	currently supported data structure(s) are: output from sessionInfo() , a character vector of package names
...,	not used
bioc_version	character. When x is a character vector, version of Bioconductor to search for package names. NULL indicates not search for Bioconductor.
no_enhances	logical, when parsing DESCRIPTION, whether to ignore packages in the "Enhances" field
no_suggests	logical, when parsing DESCRIPTION, whether to ignore packages in the "Suggests" field

Value

a vector of package references

Examples

```

as_pkgrefs(sessionInfo())
if (interactive()) {
  require(rang)
  graph <- resolve(as_pkgrefs(sessionInfo()))
  as_pkgrefs(c("rtoot"))
  as_pkgrefs(c("rtoot", "S4Vectors")) ## this gives cran::S4Vectors and is not correct.
  as_pkgrefs(c("rtoot", "S4Vectors"), bioc_version = "3.3") ## This gives bioc::S4Vectors
}

```

convert_edgelist *Convert Data Structures to rang edgelist*

Description

This generic function converts several data structures provided by rang into an edgelist of package dependencies.

Usage

```

convert_edgelist(x, ...)

## Default S3 method:
convert_edgelist(x, ...)

## S3 method for class 'ranglet'
convert_edgelist(x, ...)

## S3 method for class 'rang'
convert_edgelist(x, ...)

```

Arguments

`x`, supported data structures are rang and ranglet S3 objects
`...`, not used

Details

the resulting data frame can be converted to an igraph object for plotting and analysis via the function [igraph::graph_from_data_frame\(\)](#)

Value

a data frame of directed edges of dependencies

Examples

```
if (interactive()) {
  graph <- resolve(pkgs = c("openNLP", "LDAvis", "topicmodels", "quanteda"),
                  snapshot_date = "2020-01-16")

  # dependency edgelist of a single package
  convert_edgelist(graph$ranglets[[1]])

  # full dependency edgelist
  convert_edgelist(graph)
}
```

create_turing

Create executable research compendium according to the Turing Way

Description

This usethis-style function creates an executable research compendium according to the Turing Way.

Usage

```
create_turing(
  path,
  add_rang = TRUE,
  add_makefile = TRUE,
  add_here = TRUE,
  verbose = TRUE,
  force = FALSE,
  aptainer = FALSE
)
```

Arguments

path	character, path to the project root
add_rang	logical, whether to run <code>use_rang()</code> to path
add_makefile	logical, whether to insert a barebone Makefile in the project root.
add_here	logical, whether to insert a hidden <code>.here</code> file in the project root
verbose	logical, whether to print out messages
force	logical, whether to overwrite files (<code>inst/rang/update.R</code> , <code>Makefile</code> , <code>.here</code>) if they exist.
aptainer	logical, whether to use aptainer. FALSE indicates using Docker

Details

According to the Turing Way, an executable research compendium should have the following properties

1. Files should be organized in a conventional folder structure;
2. Data, methods, and output should be clearly separated;
3. The computational environment should be specified.

We use the structure suggested by the Turing Way:

- `data_raw`: a directory to hold the raw data
- `data_clean`: a directory to hold the processed data
- `code`: a directory to hold computer code
- `CITATION`: a file holding citation information
- `paper.Rmd`: a manuscript This function provides the a clearly separated organizational structure. Components can be changed. For example, the manuscript can be in another format (e.g. `quarto`, `sweave`) or even optional. With `add_rang`, the computational environment can be recorded and reconstructed later.

Value

path, invisibly

References

The Turing Way: Research Compendia Gorman, KB, Williams TD. and Fraser WR (2014). Ecological Sexual Dimorphism and Environmental Variability within a Community of Antarctic Penguins (Genus *Pygoscelis*). PLoS ONE 9(3):e90081. doi:10.1371/journal.pone.0090081

See Also

[use_rang\(\)](#)

dockerize

Dockerize The Resolved Result

Description

This function exports the result from `resolve()` to a Docker file. For R version $\geq 3.1.0$, the Dockerfile is based on the versioned Rocker image. For R version $< 3.1.0$, the Dockerfile is based on Debian and it compiles R from source.

Usage

```

dockerize(
  rang,
  output_dir,
  materials_dir = NULL,
  post_installation_steps = NULL,
  image = c("r-ver", "rstudio", "tidyverse", "verse", "geospatial"),
  rang_as_comment = TRUE,
  cache = FALSE,
  verbose = TRUE,
  lib = NA,
  cran_mirror = "https://cran.r-project.org/",
  check_cran_mirror = TRUE,
  bioc_mirror = "https://bioconductor.org/packages/",
  no_rocker = FALSE,
  debian_version = c("lenny", "squeeze", "wheezy", "jessie", "stretch"),
  skip_r17 = TRUE,
  insert_readme = TRUE,
  copy_all = FALSE
)

dockerize_rang(...)

dockerise(...)

dockerise_rang(...)

```

Arguments

<code>rang</code>	output from resolve()
<code>output_dir</code>	character, where to put the Docker file and associated content
<code>materials_dir</code>	character, path to the directory containing additional resources (e.g. analysis scripts) to be copied into <code>output_dir</code> and in turn into the Docker container
<code>post_installation_steps</code>	character, additional steps to be added before the CMD part of the Dockerfile, see an example below
<code>image</code>	character, which versioned Rocker image to use. Can only be "r-ver", "rstudio", "tidyverse", "verse", "geospatial" This applies only to R version ≥ 3.1
<code>rang_as_comment</code>	logical, whether to write resolved result and the steps to reproduce the file to path as comment
<code>cache</code>	logical, whether to cache the packages now. Please note that the system requirements are not cached. For query with non-CRAN packages, this option is strongly recommended. For query with local packages, this must be TRUE regardless of R version. For R version < 3.1 , this must be also TRUE if there is any non-CRAN packages.

verbose	logical, pass to <code>install.packages()</code> , the negated value is also passed as quiet to both <code>install.packages()</code> and <code>download.file()</code> .
lib	character, pass to <code>install.packages()</code> . By default, it is NA (to install the packages to the default location)
cran_mirror	character, which CRAN mirror to use
check_cran_mirror	logical, whether to check the CRAN mirror
bioc_mirror	character, which Bioconductor mirror to use
no_rocker	logical, whether to skip using Rocker images even when an appropriate version is available. Please keep this as TRUE unless you know what you are doing
debian_version	when Rocker images are not used, which EOL version of Debian to use. Can only be "lenny", "etch", "squeeze", "wheezy", "jessie", "stretch". Please keep this as default "lenny" unless you know what you are doing
skip_r17	logical, whether to skip R 1.7.x. Currently, it is not possible to compile R 1.7.x (R 1.7.0 and R 1.7.1) with the method provided by rang. It affects <code>snapshot_date</code> from 2003-04-16 to 2003-10-07. When <code>skip_r17</code> is TRUE and <code>snapshot_date</code> is within the aforementioned range, R 1.8.0 is used instead
insert_readme	logical, whether to insert a README file
copy_all	logical, whether to copy everything in the current directory into the container. If <code>inst/rang</code> is detected in <code>output_dir</code> , this is coerced to TRUE.
...	arguments to be passed to <code>dockerize</code>

Details

The idea behind this is to determine the installation order of R packages locally. Then, the installation script can be deployed to another fresh R session to install R packages. `dockerize()` and `aptainerize()` are more reasonable ways because a fresh R session with all system requirements is provided. The current approach does not work in R < 2.1.0.

Value

`output_dir`, invisibly

References

The Rocker Project Ripley, B. (2005) **Packages and their Management in R 2.1.0**. R News, 5(1):8–11.

See Also

`resolve()`, `export_rang()`, `use_rang()`

Examples

```

if (interactive()) {
  graph <- resolve(pkgs = c("openNLP", "LDavis", "topicmodels", "quanteda"),
                  snapshot_date = "2020-01-16")
  dockerize(graph, ".")
  ## An example of using post_installation_steps to install quarto
  install_quarto <- c("RUN apt-get install -y curl git && \\  

  curl -LO https://quarto.org/download/latest/quarto-linux-amd64.deb && \\  

  dpkg -i quarto-linux-amd64.deb && \\  

  quarto install tool tinytex")
  dockerize(graph, ".", post_installation_steps = install_quarto)
}

```

export_rang

Export The Resolved Result As Installation Script

Description

This function exports the results from `resolve()` to an installation script that can be run in a fresh R environment.

Usage

```

export_rang(
  rang,
  path,
  rang_as_comment = TRUE,
  verbose = TRUE,
  lib = NA,
  cran_mirror = "https://cran.r-project.org/",
  check_cran_mirror = TRUE,
  bioc_mirror = "https://bioconductor.org/packages/"
)

```

Arguments

rang	output from <code>resolve()</code>
path	character, path of the exported installation script
rang_as_comment	logical, whether to write resolved result and the steps to reproduce the file to path as comment
verbose	logical, pass to <code>install.packages()</code> , the negated value is also passed as quiet to both <code>install.packages()</code> and <code>download.file()</code> .
lib	character, pass to <code>install.packages()</code> . By default, it is NA (to install the packages to the default location)

cran_mirror character, which CRAN mirror to use
check_cran_mirror
 logical, whether to check the CRAN mirror
bioc_mirror character, which Bioconductor mirror to use

Details

The idea behind this is to determine the installation order of R packages locally. Then, the installation script can be deployed to another fresh R session to install R packages. `dockerize()` and `apptainerize()` are more reasonable ways because a fresh R session with all system requirements is provided. The current approach does not work in R < 2.1.0.

Value

path, invisibly

References

Ripley, B. (2005) [Packages and their Management in R 2.1.0](#). R News, 5(1):8–11.

See Also

`generate_installation_order()`

Examples

```
if (interactive()) {  
  graph <- resolve(pkgs = c("openNLP", "LDavis", "topicmodels", "quanteda"),  
                  snapshot_date = "2020-01-16")  
  export_rang(graph, "rang.R")  
}
```

export_renv

Export The Resolved Result As a renv Lockfile

Description

This function exports the results from `resolve()` to a renv lockfile that can be used as an alternative to a docker container.

Usage

```
export_renv(rang, path = ".")
```

Arguments

rang output from `resolve()`
path character, path of the exported renv lockfile

Details

A renv lockfile is easier to handle than a docker container, but it cannot always reliably reproduce the exact computational environment, especially for very old code.

Value

path, invisibly

Examples

```
if (interactive()) {  
  graph <- resolve(pkgs = c("openNLP", "LDAvis", "topicmodels", "quanteda"),  
                  snapshot_date = "2020-01-16")  
  export_renv(graph, ".")  
}
```

generate_installation_order

Create a Data Frame of The Resolved Result This function exports the results from `resolve()` to a data frame, which each row represents one installation step. The order of rows is the installation order. By installing packages in the specified order, one can install all the resolved packages without conflicts.

Description

Create a Data Frame of The Resolved Result This function exports the results from `resolve()` to a data frame, which each row represents one installation step. The order of rows is the installation order. By installing packages in the specified order, one can install all the resolved packages without conflicts.

Usage

```
generate_installation_order(rang)
```

Arguments

rang output from `resolve()`

Value

A data frame ordered by installation order.

References

Ripley, B. (2005) [Packages and their Management in R 2.1.0](#). R News, 5(1):8–11.

Examples

```
if (interactive()) {
  graph <- resolve(pkgs = c("openNLP", "LDAvis", "topicmodels", "quanteda"),
                  snapshot_date = "2020-01-16")
  generate_installation_order(graph)
}
```

query_sysreqs

Query for System Requirements

Description

This function takes an S3 object returned from [resolve\(\)](#) and (re)queries the System Requirements.

Usage

```
query_sysreqs(rang, os = "ubuntu-20.04")
```

Arguments

rang	output from resolve()
os	character, which OS to query for system requirements

Value

a rang S3 object with the following items

call	original function call
ranglets	List of dependency graphs of all packages in pkgs
snapshot_date	snapshot_date
no_enhances	no_enhances
no_suggests	no_suggests
unresolved_pkgsrefs	Packages that can't be resolved
sysreqs	System requirements as Linux commands
r_version	The latest R version as of snapshot_date
os	os

See Also[resolve\(\)](#)**Examples**

```
if (interactive()) {
  graph <- resolve(pkgs = c("openNLP", "LDAvis", "topicmodels", "quanteda"),
                  snapshot_date = "2020-01-16", query_sysreqs = FALSE)
  graph$sysreqs
  graph2 <- query_sysreqs(graph, os = "ubuntu-20.04")
  graph2$sysreqs
}
```

recipes

Recipes for Building Container Images

Description

A list containing several useful recipes for container building. Useful for the `post_installation_steps` argument of [dockerize\(\)](#). Available recipes are:

- `texlive`: install pandoc and LaTeX, useful for rendering RMarkdown
- `texlivefull`: Similar to the above, but install the full distribution of TeX Live (~ 3GB)
- `quarto`: install quarto and tinytex
- `clean`: clean up the container image by removing cache
- `make`: install GNU make

Usage

```
recipes
```

Format

An object of class `list` of length 5.

Examples

```
if (interactive()) {
  graph <- resolve(pkgs = c("openNLP", "LDAvis", "topicmodels", "quanteda"),
                  snapshot_date = "2020-01-16")
  ## install texlive
  dockerize(graph, ".", post_installation_steps = recipes[['texlive']])
}
```

 resolve

Resolve Dependencies Of R Packages

Description

This function recursively queries dependencies of R packages at a specific snapshot time. The dependency graph can then be used to recreate the computational environment. The data on dependencies are provided by R-hub.

Usage

```
resolve(
  pkgs = ".",
  snapshot_date,
  no_enhances = TRUE,
  no_suggests = TRUE,
  query_sysreqs = TRUE,
  os = "ubuntu-20.04",
  verbose = FALSE
)
```

Arguments

pkgs	pkgs can be 1) a character vector of R packages to resolve, 2) a path to a renv lockfile , or 3) a data structure that as_pkgrefs() can convert to a character vector of package references. For 1) pkgs can be either in shorthands, e.g. "rtoot", "ropensci/readODS", or in package references, e.g. "cran::rtoot", "github::ropensci/readODS". Please refer to the Package References documentation of pak for details. Currently, this package supports only cran and github packages. For 2) as_pkgrefs() support the output of sessionInfo() , a renv lockfile or a single directory. If it is a single directory, all R scripts are scanned for R packages used using renv::dependencies() . Currently, the default is to scan the R scripts in the current working directory. Please also note that this scanning only assumes there are CRAN and Bioconductor packages. We strongly recommend checking whether this is really the case (see example below).
snapshot_date	Snapshot date, if not specified, assume to be a month ago
no_enhances	logical, whether to ignore packages in the "Enhances" field
no_suggests	logical, whether to ignore packages in the "Suggests" field
query_sysreqs	logical, whether to query for System Requirements. Important: Archived CRAN can't be queried for system requirements. Those packages are assumed to have no system requirement.
os	character, which OS to query for system requirements
verbose	logical, whether to display messages

Value

a rang S3 object with the following items

call	original function call
ranglets	List of dependency graphs of all packages in pkgs
snapshot_date	snapshot_date
no_enhances	no_enhances
no_suggests	no_suggests
unresolved_pkgsrefs	Packages that can't be resolved
sysreqs	System requirements as Linux commands
r_version	The latest R version as of snapshot_date
os	os

References

[Package References](#)

See Also

[dockerize\(\)](#)

Examples

```
if (interactive()) {
  graph <- resolve(pkgs = c("openNLP", "LDAvis", "topicmodels", "quanteda"),
                  snapshot_date = "2020-01-16")
  graph
  ## to resolve github packages
  gh_graph <- resolve(pkgs = c("https://github.com/schochastics/rtoot"),
                    snapshot_date = "2022-11-28")
  gh_graph
  ## scanning
  graph <- resolve(snapshot_date = "2022-11-28")
  ## But we recommend this:
  pkgs <- as_pkgrefs(".")
  pkgs ## check the accuracy
  graph <- resolve(pkgs, snapshot_date = "2022-11-28")
}
```

use_rang	<i>Setup rang for a directory</i>
----------	-----------------------------------

Description

This `usethis`-style function adds the infrastructure in a directory (presumably with R scripts and data) for (re)constructing the computational environment. Specifically, this function inserts `inst/rang` into the directory, which contains all components for the reconstruction. Optionally, `Makefile` and `.here` are also inserted to ease the development of analytic code. By default, (re)running this function does not overwrite any file. One can change this by setting `force` to `TRUE`.

Usage

```
use_rang(
  path = ".",
  add_makefile = TRUE,
  add_here = TRUE,
  verbose = TRUE,
  force = FALSE,
  aptainer = FALSE
)
```

Arguments

<code>path</code>	character, path to the project root
<code>add_makefile</code>	logical, whether to insert a barebone <code>Makefile</code> in the project root.
<code>add_here</code>	logical, whether to insert a hidden <code>.here</code> file in the project root
<code>verbose</code>	logical, whether to print out messages
<code>force</code>	logical, whether to overwrite files (<code>inst/rang/update.R</code> , <code>Makefile</code> , <code>.here</code>) if they exist.
<code>aptainer</code>	logical, whether to use <code>aptainer</code> . <code>FALSE</code> indicates using <code>Docker</code>

Details

The infrastructure being added to your path consists of:

- `inst/rang` directory in the project root
- `update.R` file inside the directory
- `.here` in the project root (if `add_here` is `TRUE`)
- `Makefile` in the project root (if `add_makefile` is `TRUE`) You might need to edit `update.R` manually. The default is to scan the whole project for used R packages and assume they are either on CRAN or Bioconductor. If you have used other R packages, you might need to edit this manually.

Value

path, invisibly

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