



ETC4500/ETC5450 Advanced R programming

Week 5: Reactive programming with targets and renv



Outline

- 1 targets
- 2 Reproducible environments

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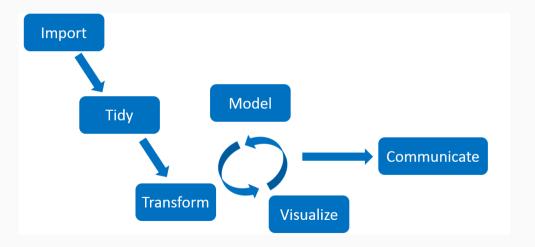
- 1 targets
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targets: reproducible computation at scale

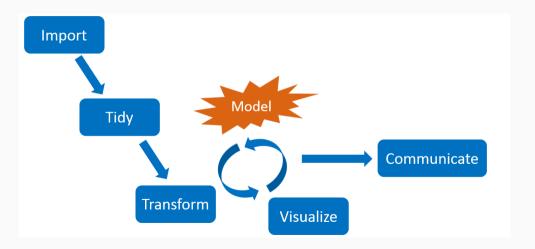


- Supports a clean, modular, function-oriented programming style.
- Learns how your pipeline fits together.
- Runs only the necessary computation.
- Abstracts files as R objects.
- Similar to Makefiles, but with R functions.

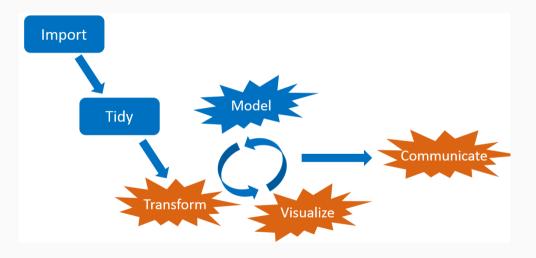
Interconnected tasks



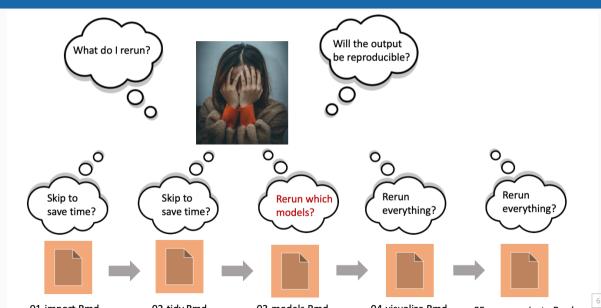
Interconnected tasks



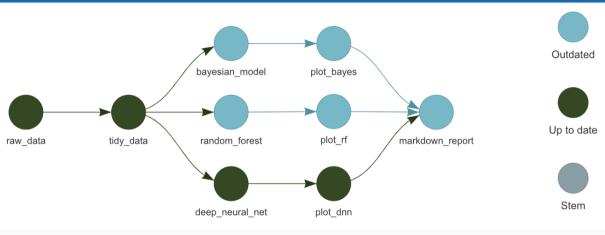
Interconnected tasks



Dilemma: short runtimes or reproducible results?



Let a pipeline tool do the work



- Save time while ensuring computational reproducibility.
- Automatically skip tasks that are already up to date.

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Typical project structure

```
_targets.R # Required top-level configuration file.
R/
L— functions.R
data/
L— my_data.csv
```

_targets.R

```
library(targets)
tar_source() # source all files in R folder
tar_option_set(packages = c("tidyverse", "fable"))
list(
   tar_target(my_file, "data/my_data.csv", format = "file"),
   tar_target(my_data, read_csv(my_file)),
   tar_target(my_model, model_function(my_data))
)
```

Generate _targets.R in working directory

library(targets)
tar_script()

Useful targets commands

- tar_make() to run the pipeline.
- tar_make(starts_with("fig")) to run only targets
 starting with "fig".
- tar_read(object) to read a target.
- tar_load(object) to load a target.
- tar_load_everything() to load all targets.
- tar_manifest() to list all targets
- tar_visnetwork() to visualize the pipeline.
- tar_destroy() to remove all targets.
- tar_outdated() to list outdated targets.

Errored targets to return NULL so pipeline continues.

```
tar_option_set(error = "null")
```

Errored targets to return NULL so pipeline continues.

```
tar_option_set(error = "null")
```

See error messages for all targets.

```
tar_meta(fields = error, complete_only = TRUE)
```

Errored targets to return NULL so pipeline continues.

```
tar_option_set(error = "null")
```

See error messages for all targets.

```
tar_meta(fields = error, complete_only = TRUE)
```

See warning messages for all targets.

```
tar_meta(fields = warnings, complete_only = TRUE)
```

- Try loading all available targets: tar_load_everything().
 Then run the command of the errored target in the console.
- Pause the pipeline with browser()
- Use the debug option: tar_option_set(debug =
 "target_name")
- Save the workspaces:
 - tar_option_set(workspace_on_error = TRUE)
 - tar_workspaces()
 - tar_workspace(target_name)

Random numbers

- Each target runs with its own seed based on its name and the global seed from tar_option_set(seed = ???)
- So running only some targets, or running them in a different order, will not change the results.

Folder structure

```
.git/
.Rprofile
.Renviron
renv/
index.Rmd
_targets/
_targets.R
_targets.yaml
R/
  functions_data.R
  functions_analysis.R
  functions_visualization.R
data/
- input_data.csv
```

targets with quarto

```
library(targets)
library(tarchetypes)
tar_source() # source all files in R folder
tar_option_set(packages = c("tidyverse", "fable"))
list(
   tar_target(my_file, "data/my_data.csv", format = "file"),
   tar_target(my_data, read_csv(my_file)),
   tar_target(my_model, model_function(my_data))
   tar_quarto(report, "file.qmd", extra_files = "references.bib")
)
```

- 1 Load tarchetypes package for quarto support.
- 2 Add a quarto target.

Exercise

- Add a targets workflow to your quarto document.
- Create a visualization of the pipeline network using tar_visnetwork().

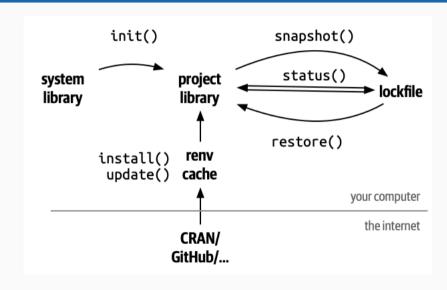
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Reproducible environments

- To ensure that your code runs the same way on different machines and at different times, you need the computing environment to be the same.
 - Operating system
 - 2 System components
 - 3 R version
 - 4 R packages
- Solutions for 1–4: Docker, Singularity, containerit, rang
- Solutions for 4: packrat, checkpoint, renv

renv package



renv package

- renv::init(): initialize a new project with a new environment. Adds:
 - renv/library contains all packages used in project
 - renv.lock contains metadata about packages used in project
 - .Rprofile run every time R starts.
- renv::snapshot(): save the state of the project to renv.lock.
- renv::restore(): restore the project to the state saved in renv.lock.

renv package

- renv uses a package cache so you are not repeatedly installing the same packages in multiple projects.
- renv::install() can install from CRAN, Bioconductor, GitHub, Gitlab, Bitbucket, etc.
- renv::update() gets latest versions of all dependencies from wherever they were installed from.
- Only R packages are supported, not system dependencies, and not R itself.
- renv is not a replacement for Docker or Singularity.
- renv::deactivate(clean = TRUE) will remove the renv environment.