

Package ‘vetiver’

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Title Version, Share, Deploy, and Monitor Models

Version 0.1.4

Description The goal of 'vetiver' is to provide fluent tooling to version, share, deploy, and monitor a trained model. Functions handle both recording and checking the model's input data prototype, and predicting from a remote API endpoint. The 'vetiver' package is extensible, with generics that can support many kinds of models.

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URL <https://vetiver.tidymodels.org/>,
<https://github.com/tidymodels/vetiver-r>

BugReports <https://github.com/tidymodels/vetiver-r/issues>

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api_spec	<i>Update the OpenAPI specification using model metadata</i>
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Description

Update the OpenAPI specification using model metadata

Usage

```
api_spec(spec, vetiver_model, path, all_docs = TRUE)

glue_spec_summary(ptype, return_type)

## Default S3 method:
glue_spec_summary(ptype, return_type = NULL)

## S3 method for class 'data.frame'
glue_spec_summary(ptype, return_type = "predictions")

## S3 method for class 'array'
glue_spec_summary(ptype, return_type = "predictions")
```

Arguments

spec	An OpenAPI Specification formatted list object
vetiver_model	A deployable <code>vetiver_model()</code> object
path	The endpoint path

all_docs	Should the interactive visual API documentation be created for <i>all</i> POST endpoints in the router <code>pr</code> ? This defaults to TRUE, and assumes that all POST endpoints use the <code>vetiver_model\$type</code> input data prototype.
ptype	An input data prototype from a model
return_type	Character string to describe what endpoint returns, such as "predictions"

Value

`api_spec()` returns the updated OpenAPI Specification object. This function uses `glue_spec_summary()` internally, which returns a glue character string.

Examples

```
library(plumber)
cars_lm <- lm(mpg ~ ., data = mtcars)
v <- vetiver_model(cars_lm, "cars_linear")

glue_spec_summary(v$type)

modify_spec <- function(spec) api_spec(spec, v, "/predict")
pr() %>% pr_set_api_spec(api = modify_spec)
```

attach_pkgs

Fully attach or load packages for making model predictions

Description

These are developer-facing functions, useful for supporting new model types. Some models require one or more R packages to be fully attached to make predictions, and some require only that the namespace of one or more R packages is loaded.

Usage

```
attach_pkgs(pkgs)
```

```
load_pkgs(pkgs)
```

Arguments

`pkgs` A character vector of package names to load or fully attach.

Details

These two functions will attempt either to:

- fully attach or
- load

the namespace of the pkgs vector of package names, preserving the current random seed.

To learn more about load vs. attach, read the [NAMESPACE chapter of R Packages](#). For deploying a model, it is likely safer to fully attach needed packages but that comes with the risk of naming conflicts between packages.

Value

An invisible TRUE.

Examples

```
## succeed
load_pkgs(c("knitr", "readr"))
attach_pkgs(c("knitr", "readr"))

## fail
try(load_pkgs(c("bloopy", "readr")))
try(attach_pkgs(c("bloopy", "readr")))
```

handler_startup.train *Model handler functions for API endpoint*

Description

These are developer-facing functions, useful for supporting new model types. Each model supported by `vetiver_model()` uses two handler functions in `vetiver_api()`:

- The `handler_startup` function executes when the API starts. Use this function for tasks like loading packages. A model can use the default method here, which is NULL (to do nothing at startup).
- The `handler_predict` function executes at each API call. Use this function for calling `predict()` and any other tasks that must be executed at each API call.

Usage

```
## S3 method for class 'train'
handler_startup(vetiver_model)

## S3 method for class 'train'
handler_predict(vetiver_model, ...)
```

```
## S3 method for class 'glm'
handler_predict(vetiver_model, ...)

handler_startup(vetiver_model)

## Default S3 method:
handler_startup(vetiver_model)

handler_predict(vetiver_model, ...)

## Default S3 method:
handler_predict(vetiver_model, ...)

## S3 method for class 'lm'
handler_predict(vetiver_model, ...)

## S3 method for class 'Learner'
handler_startup(vetiver_model)

## S3 method for class 'Learner'
handler_predict(vetiver_model, ...)

## S3 method for class 'ranger'
handler_startup(vetiver_model)

## S3 method for class 'ranger'
handler_predict(vetiver_model, ...)

## S3 method for class 'workflow'
handler_startup(vetiver_model)

## S3 method for class 'workflow'
handler_predict(vetiver_model, ...)

## S3 method for class 'xgb.Booster'
handler_startup(vetiver_model)

## S3 method for class 'xgb.Booster'
handler_predict(vetiver_model, ...)
```

Arguments

`vetiver_model` A deployable `vetiver_model()` object
... Other arguments passed to `predict()`, such as prediction type

Details

These are two generics that use the class of `vetiver_model$model` for dispatch.

Value

A `handler_startup` function should return invisibly, while a `handler_predict` function should return a function with the signature `function(req)`. The request body (`req$body`) consists of the new data at prediction time; this function should return predictions either as a tibble or as a list coercable to a tibble via `tibble::as_tibble()`.

Examples

```
cars_lm <- lm(mpg ~ ., data = mtcars)
v <- vetiver_model(cars_lm, "cars_linear")
handler_startup(v)
handler_predict(v)
```

map_request_body	<i>Identify data types for each column in an input data prototype</i>
------------------	---

Description

The OpenAPI specification of a Plumber API created via `plumber::pr()` can be modified via `plumber::pr_set_api_spec()`, and this helper function will identify data types of predictors and create a list to use in this specification. These are *not* R data types, but instead basic JSON data types. For example, factors in R will be documented as strings in the OpenAPI specification.

Usage

```
map_request_body(pdtype)
```

Arguments

`pdtype` An input data prototype from a model

Details

This is a developer-facing function, useful for supporting new model types. It is called by `api_spec()`.

Value

A list to be used within `plumber::pr_set_api_spec()`

Examples

```
map_request_body(vctrs::vec_slice(chickwts, 0))
```

`predict.vetiver_endpoint`

Post new data to a deployed model API endpoint and return predictions

Description

Post new data to a deployed model API endpoint and return predictions

Usage

```
## S3 method for class 'vetiver_endpoint'  
predict(object, new_data, ...)
```

Arguments

<code>object</code>	A model API endpoint object created with <code>vetiver_endpoint()</code> .
<code>new_data</code>	New data for making predictions, such as a data frame.
<code>...</code>	Extra arguments passed to <code>httr::POST()</code>

Value

A tibble of model predictions with as many rows as in `new_data`.

Examples

```
if (FALSE) {  
  endpoint <- vetiver_endpoint("http://127.0.0.1:8088/predict")  
  predict(endpoint, mtcars[4:7, -1])  
}
```

`vetiver_api`

Create a Plumber API to predict with a deployable `vetiver_model()` object

Description

Use `vetiver_api()` to add a POST endpoint for predictions from a trained `vetiver_model()` to a Plumber router.

Usage

```

vetiver_api(
  pr,
  vetiver_model,
  path = "/predict",
  debug = is_interactive(),
  ...
)

vetiver_pr_post(
  pr,
  vetiver_model,
  path = "/predict",
  debug = is_interactive(),
  ...,
  check_ptype = TRUE
)

vetiver_pr_docs(pr, vetiver_model, path = "/predict", all_docs = TRUE)

```

Arguments

<code>pr</code>	A Plumber router, such as from <code>plumber::pr()</code> .
<code>vetiver_model</code>	A deployable <code>vetiver_model()</code> object
<code>path</code>	The endpoint path
<code>debug</code>	TRUE provides more insight into your API errors.
<code>...</code>	Other arguments passed to <code>predict()</code> , such as prediction type
<code>check_ptype</code>	Should the <code>ptype</code> stored in <code>vetiver_model</code> (used for visual API documentation) also be used to check new data at prediction time? Defaults to TRUE.
<code>all_docs</code>	Should the interactive visual API documentation be created for <i>all</i> POST endpoints in the router <code>pr</code> ? This defaults to TRUE, and assumes that all POST endpoints use the <code>vetiver_model\$ptype</code> input data prototype.

Details

You can first store and version your `vetiver_model()` with `vetiver_pin_write()`, and then create an API endpoint with `vetiver_api()`.

Setting `debug = TRUE` may expose any sensitive data from your model in API errors.

Two GET endpoints will also be added to the router `pr`, depending on the characteristics of the model object: a `/pin-url` endpoint to return the URL of the pinned model and a `/ping` endpoint for the API health.

The function `vetiver_api()` uses:

- `vetiver_pr_post()` for endpoint definition and
- `vetiver_pr_docs()` to create visual API documentation

These modular functions are available for more advanced use cases.

Value

A Plumber router with the prediction endpoint added.

Examples

```
cars_lm <- lm(mpg ~ ., data = mtcars)
v <- vetiver_model(cars_lm, "cars_linear")

library(plumber)
pr() %>% vetiver_api(v)
## is the same as:
pr() %>% vetiver_pr_post(v) %>% vetiver_pr_docs(v)
## for either, next, pipe to `pr_run()``
```

vetiver_create_description.train

Model constructor methods

Description

These are developer-facing functions, useful for supporting new model types. Each model supported by `vetiver_model()` uses up to four methods when the deployable object is created:

- The `vetiver_create_description()` function generates a helpful description of the model based on its characteristics. This method is required.
- The `vetiver_create_meta()` function creates the correct `vetiver_meta()` for the model. This is especially helpful for specifying which packages are needed for prediction. A model can use the default method here, which is to have no special metadata.
- The `vetiver_ptype()` function finds an input data prototype from the training data (a zero-row slice) to use for checking at prediction time. This method is required.
- The `vetiver_prepare_model()` function executes last. Use this function for tasks like checking if the model is trained and reducing the size of the model via `butcher::butcher()`. A model can use the default method here, which is to return the model without changes.

Usage

```
## S3 method for class 'train'
vetiver_create_description(model)

## S3 method for class 'train'
vetiver_prepare_model(model)

## S3 method for class 'glm'
vetiver_create_description(model)
```

```
## S3 method for class 'glm'  
vetiver_prepare_model(model)  
  
## S3 method for class 'lm'  
vetiver_create_description(model)  
  
## S3 method for class 'lm'  
vetiver_prepare_model(model)  
  
## S3 method for class 'Learner'  
vetiver_create_description(model)  
  
## S3 method for class 'Learner'  
vetiver_prepare_model(model)  
  
vetiver_create_description(model)  
  
## Default S3 method:  
vetiver_create_description(model)  
  
vetiver_prepare_model(model)  
  
## Default S3 method:  
vetiver_prepare_model(model)  
  
## S3 method for class 'ranger'  
vetiver_create_description(model)  
  
## S3 method for class 'ranger'  
vetiver_prepare_model(model)  
  
## S3 method for class 'workflow'  
vetiver_create_description(model)  
  
## S3 method for class 'workflow'  
vetiver_prepare_model(model)  
  
## S3 method for class 'xgb.Booster'  
vetiver_create_description(model)
```

Arguments

model A trained model, such as an `lm()` model or a tidymodels `workflows::workflow()`.

Details

These are four generics that use the class of `model` for dispatch.

Examples

```
cars_lm <- lm(mpg ~ ., data = mtcars)
vetiver_create_description(cars_lm)
vetiver_prepare_model(cars_lm)
```

```
vetiver_create_meta.train
```

Metadata constructors for vetiver_model() object

Description

These are developer-facing functions, useful for supporting new model types. The metadata stored in a `vetiver_model()` object has four elements:

- `$user`, the metadata supplied by the user
- `$version`, the version of the pin (which can be `NULL` before pinning)
- `$url`, the URL where the pin is located, if any
- `$required_pkgs`, a character string of R packages required for prediction

Usage

```
## S3 method for class 'train'
vetiver_create_meta(model, metadata)

vetiver_meta(user = list(), version = NULL, url = NULL, required_pkgs = NULL)

vetiver_create_meta(model, metadata)

## Default S3 method:
vetiver_create_meta(model, metadata)

## S3 method for class 'Learner'
vetiver_create_meta(model, metadata)

## S3 method for class 'ranger'
vetiver_create_meta(model, metadata)

## S3 method for class 'workflow'
vetiver_create_meta(model, metadata)

## S3 method for class 'xgb.Booster'
vetiver_create_meta(model, metadata)
```

Arguments

model	A trained model, such as an <code>lm()</code> model or a <code>tidymodels::workflow()</code> .
metadata	A list containing additional metadata to store with the pin. When retrieving the pin, this will be stored in the user key, to avoid potential clashes with the metadata that pins itself uses.
user	Metadata supplied by the user
version	Version of the pin
url	URL for the pin, if any
required_pkgs	Character string of R packages required for prediction

Value

The `vetiver_meta()` constructor returns a list. The `vetiver_create_meta` function returns a `vetiver_meta()` list.

Examples

```
vetiver_meta()

cars_lm <- lm(mpg ~ ., data = mtcars)
vetiver_create_meta(cars_lm, list())
```

vetiver_deploy_rsconnect

Deploy a vetiver model API to RStudio Connect

Description

Use `vetiver_deploy_rsconnect()` to deploy a `vetiver_model()` that has been versioned and stored via `vetiver_pin_write()` as a Plumber API on RStudio Connect.

Usage

```
vetiver_deploy_rsconnect(
  board,
  name,
  version = NULL,
  predict_args = list(),
  appTitle = glue::glue("{name} model API"),
  ...
)
```

Arguments

board	A pin board, created by board_folder() , board_rsconnect() , board_url() or another board_ function.
name	Pin name.
version	Retrieve a specific version of a pin. Use pin_versions() to find out which versions are available and when they were created.
predict_args	A list of optional arguments passed to vetiver_api() such as the endpoint path or prediction type.
appTitle	The API title on RStudio Connect. Use the default based on name, or pass in your own title.
...	Other arguments passed to rsconnect::deployApp() such as account or launch.browser.

Value

The deployment success (TRUE or FALSE), invisibly.

See Also

[vetiver_write_plumber\(\)](#)

Examples

```
library(pins)
tmp <- tempfile()
b <- board_temp(versioned = TRUE)
cars_lm <- lm(mpg ~ ., data = mtcars)
v <- vetiver_model(cars_lm, "cars_linear")
vetiver_pin_write(b, v)

if (FALSE) {
  vetiver_deploy_rsconnect(b, "cars_linear", predict_args = list(debug = TRUE))
}
```

vetiver_endpoint *Create a model API endpoint object for prediction*

Description

Create a model API endpoint object for prediction

Usage

```
vetiver_endpoint(url)
```

Arguments

`url` An API endpoint URL

Value

A new `vetiver_endpoint` object

Examples

```
vetiver_endpoint("https://colorado.rstudio.com/rsc/biv_svm_api/predict")
```

<code>vetiver_model</code>	<i>Create a vetiver object for deployment of a trained model</i>
----------------------------	--

Description

A `vetiver_model()` object collects the information needed to store, version, and deploy a trained model. Once your `vetiver_model()` object has been created, you can:

- store and version it as a pin with `vetiver_pin_write()`
- create an API endpoint for it with `vetiver_api()`

Usage

```
vetiver_model(
  model,
  model_name,
  ...,
  description = NULL,
  metadata = list(),
  save_ptype = TRUE,
  versioned = NULL
)
```

```
new_vetiver_model(model, model_name, description, metadata, ptype, versioned)
```

Arguments

`model` A trained model, such as an `lm()` model or a tidymodels `workflows::workflow()`.

`model_name` Model name or ID.

... Other method-specific arguments passed to `vetiver_ptype()` to compute an input data prototype, such as `ptype_data` (a sample of training features).

`description` A detailed description of the model. If omitted, a brief description of the model will be generated.

metadata	A list containing additional metadata to store with the pin. When retrieving the pin, this will be stored in the user key, to avoid potential clashes with the metadata that pins itself uses.
save_ptype	Should an input data prototype be stored with the model? The options are TRUE (the default, which stores a zero-row slice of the training data), FALSE (no input data prototype for visual documentation or checking), or a dataframe to be used for both checking at prediction time <i>and</i> examples in API visual documentation.
versioned	Should the model object be versioned when stored with <code>vetiver_pin_write()</code> ? The default, NULL, will use the default for the board where you store the model.
ptype	An input data prototype. If NULL, there is no checking of new data at prediction time.

Details

You can provide your own data to `save_ptype` to use as examples in the visual documentation created by `vetiver_api()`. If you do this, consider checking that your input data prototype has the same structure as your training data (perhaps with `hardhat::scream()`) and/or simulating data to avoid leaking PII via your deployed model.

Value

A new `vetiver_model` object.

Examples

```
cars_lm <- lm(mpg ~ ., data = mtcars)
vetiver_model(cars_lm, "cars_linear", pins::board_temp())
```

`vetiver_pin_write` *Read and write a trained model to a board of models*

Description

Use `vetiver_pin_write()` to pin a trained model to a board of models, along with an input prototype for new data and other model metadata. Use `vetiver_pin_read()` to retrieve that pinned object.

Usage

```
vetiver_pin_write(board, vetiver_model)

vetiver_pin_read(board, name, version = NULL)
```

Arguments

board	A pin board, created by <code>board_folder()</code> , <code>board_rsconnect()</code> , <code>board_url()</code> or another <code>board_</code> function.
vetiver_model	A deployable <code>vetiver_model()</code> object
name	Pin name.
version	Retrieve a specific version of a pin. Use <code>pin_versions()</code> to find out which versions are available and when they were created.

Details

These functions read and write a `vetiver_model()` pin on the specified board containing the model object itself and other elements needed for prediction, such as the model's input data prototype or which packages are needed at prediction time. You may use `pins::pin_read()` or `pins::pin_meta()` to handle the pin, but `vetiver_pin_read()` returns a `vetiver_model()` object ready for deployment.

Value

`vetiver_pin_read()` returns a `vetiver_model()`; `vetiver_pin_write()` returns the name of the new pin, invisibly.

Examples

```
library(pins)
model_board <- board_temp()

cars_lm <- lm(mpg ~ ., data = mtcars)
v <- vetiver_model(cars_lm, "cars_linear")
vetiver_pin_write(model_board, v)
model_board

vetiver_pin_read(model_board, "cars_linear")

# can use `version` argument to read a specific version:
pin_versions(model_board, "cars_linear")
```

vetiver_ptype.train *Create a vetiver input data prototype*

Description

Optionally find and return an input data prototype for a model.

Usage

```
## S3 method for class 'train'
vetiver_ptype(model, ...)

## S3 method for class 'glm'
vetiver_ptype(model, ...)

## S3 method for class 'lm'
vetiver_ptype(model, ...)

## S3 method for class 'Learner'
vetiver_ptype(model, ...)

vetiver_ptype(model, ...)

## Default S3 method:
vetiver_ptype(model, ...)

vetiver_create_ptype(model, save_ptype, ...)

## S3 method for class 'ranger'
vetiver_ptype(model, ...)

## S3 method for class 'workflow'
vetiver_ptype(model, ...)

## S3 method for class 'xgb.Booster'
vetiver_ptype(model, ...)
```

Arguments

model	A trained model, such as an <code>lm()</code> model or a tidymodels <code>workflows::workflow()</code> .
...	Other method-specific arguments passed to <code>vetiver_ptype()</code> to compute an input data prototype, such as <code>ptype_data</code> (a sample of training features).
save_ptype	Should an input data prototype be stored with the model? The options are TRUE (the default, which stores a zero-row slice of the training data), FALSE (no input data prototype for visual documentation or checking), or a dataframe to be used for both checking at prediction time <i>and</i> examples in API visual documentation.

Details

These are developer-facing functions, useful for supporting new model types. A `vetiver_model()` object optionally stores an input data prototype for checking at prediction time.

- The default for `save_ptype`, TRUE, finds an input data prototype (a zero-row slice of the training data) via `vetiver_ptype()`.
- `save_ptype = FALSE` opts out of storing any input data prototype.

- You may pass your own data to `save_ptype`, but be sure to check that it has the same structure as your training data, perhaps with `hardhat::scream()`.

Value

A `vetiver_ptype` method returns a zero-row dataframe, and `vetiver_create_ptype()` returns either such a zero-row dataframe, NULL, or the dataframe passed to `save_ptype`.

Examples

```
cars_lm <- lm(mpg ~ cyl + disp, data = mtcars)

vetiver_create_ptype(cars_lm, TRUE)

## calls the right method for `model` via:
vetiver_ptype(cars_lm)

## can also turn off `ptype`
vetiver_create_ptype(cars_lm, FALSE)

## some models require that you pass in training features
cars_rf <- ranger::ranger(mpg ~ ., data = mtcars)
vetiver_ptype(cars_rf, ptype_data = mtcars[,-1])
```

`vetiver_type_convert` *Convert new data at prediction time using input data prototype*

Description

This is a developer-facing function, useful for supporting new model types. At prediction time, new observations typically must be checked and sometimes converted to the data types from training time.

Usage

```
vetiver_type_convert(new_data, ptype)
```

Arguments

<code>new_data</code>	New data for making predictions, such as a data frame.
<code>ptype</code>	An input data prototype, such as a 0-row slice of the training data

Value

A converted dataframe

Examples

```
library(tibble)
training_df <- tibble(x = as.Date("2021-01-01") + 0:9,
                     y = LETTERS[1:10], z = letters[11:20])
training_df

ptype <- vctrs::vec_slice(training_df, 0)
vetiver_type_convert(tibble(x = "2021-02-01", y = "J", z = "k"), ptype)

## unsuccessful conversion generates an error:
try(vetiver_type_convert(tibble(x = "potato", y = "J", z = "k"), ptype))

## error for missing column:
try(vetiver_type_convert(tibble(x = "potato", y = "J"), ptype))
```

vetiver_write_docker *Write a Dockerfile for a vetiver model*

Description

After creating a Plumber file with `vetiver_write_plumber()`, use `vetiver_write_docker()` to create a Dockerfile plus an `renv.lock` file for a pinned `vetiver_model()`.

Usage

```
vetiver_write_docker(
  vetiver_model,
  plumber_file = "plumber.R",
  path = ".",
  rspm = TRUE,
  port = 8000
)
```

Arguments

<code>vetiver_model</code>	A deployable <code>vetiver_model()</code> object
<code>plumber_file</code>	A path for your Plumber file, created via <code>vetiver_write_plumber()</code> . Defaults to <code>plumber.R</code> in the working directory.
<code>path</code>	A path to write the Dockerfile and <code>renv.lock</code> lockfile, capturing the model's package dependencies. Defaults to the working directory.
<code>rspm</code>	A logical to use the RStudio Public Package Manager for <code>renv::restore()</code> in the Docker image. Defaults to <code>TRUE</code> .
<code>port</code>	The server port for listening: a number such as 8080 or an expression like <code>'as.numeric(Sys.getenv("PORT"))'</code> when the port is injected as an environment variable.

Value

The content of the Dockerfile, invisibly.

Examples

```
library(pins)
tmp_plumber <- tempfile()
b <- board_temp(versioned = TRUE)
cars_lm <- lm(mpg ~ ., data = mtcars)
v <- vetiver_model(cars_lm, "cars_linear")
vetiver_pin_write(b, v)
vetiver_write_plumber(b, "cars_linear", file = tmp_plumber)

## default port
vetiver_write_docker(v, tmp_plumber, tempdir())
## port from env variable
vetiver_write_docker(v, tmp_plumber, tempdir(),
  port = 'as.numeric(Sys.getenv("PORT"))')
```

`vetiver_write_plumber` *Write a deployable Plumber file for a vetiver model*

Description

Use `vetiver_write_plumber()` to create a plumber.R file for a `vetiver_model()` that has been versioned and stored via `vetiver_pin_write()`.

Usage

```
vetiver_write_plumber(board, name, version = NULL, ..., file = "plumber.R")
```

Arguments

<code>board</code>	A pin board, created by <code>board_folder()</code> , <code>board_rsconnect()</code> , <code>board_url()</code> or another <code>board_</code> function.
<code>name</code>	Pin name.
<code>version</code>	Retrieve a specific version of a pin. Use <code>pin_versions()</code> to find out which versions are available and when they were created.
<code>...</code>	Other arguments passed to <code>vetiver_api()</code> such as the endpoint path or prediction type.
<code>file</code>	A path to write the Plumber file. Defaults to <code>plumber.R</code> in the working directory. See <code>plumber::plumb()</code> for naming precedence rules.

Details

By default, this function will find and use the latest version of your vetiver model; the model API (when deployed) will be linked to that specific version. You can override this default behavior by choosing a specific version.

Value

The content of the plumber .R file, invisibly.

Examples

```
library(pins)
tmp <- tempfile()
b <- board_temp(versioned = TRUE)
cars_lm <- lm(mpg ~ ., data = mtcars)
v <- vetiver_model(cars_lm, "cars_linear")
vetiver_pin_write(b, v)

vetiver_write_plumber(b, "cars_linear", file = tmp)
```

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