Multivariate forecasting

```
library(tidyverse)
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.1 --
```

```
## v ggplot2 3.3.6     v purrr   0.3.4
## v tibble  3.1.7     v dplyr   1.0.9
## v tidyr   1.2.0     v stringr 1.4.0
## v readr   2.1.2     v forcats 0.5.1
```

```
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
source("multivariate_forecasting.R")
source("initialization_functions.R")
source("constrained_gls.R")
source("mle.R")
```

We will make a synthetic data set of 5 weeks of call volume from two streams, assuming each day is divided into four time intervals.

```
set.seed(101)

df <- tibble(
  stream = rep(1:2, each = 5*7*4),
  call_volume = rpois(5*7*4*2, 5),
  wd = rep(1:7, 5*4*2),
  d = rep(1:(5*7), each = 4) %>% rep(2),
  t = rep(1:4, 5*7*2)
)
```

```
head(df)
```

```
## # A tibble: 6 x 5
##   stream call_volume    wd     d     t
##    <int>       <int> <int> <int> <int>
## 1      1           4     1     1     1
## 2      1           2     2     1     2
## 3      1           6     3     1     3
## 4      1           6     4     1     4
## 5      1           3     5     2     1
## 6      1           4     6     2     2
```

```
rslt <- multivariate_forecasting(
  df = df,
  horizon = 7*4,
  max_iter = 100,
  algo = "NLOPT_LD_LBFGS",
  verbose = FALSE
)
```

```
## Loading required package: MTS
```

```
## Loading required package: lubridate
```

```
##
## Attaching package: 'lubridate'
```

```
## The following objects are masked from 'package:base':
##
##     date, intersect, setdiff, union
```

```
## Loading required package: CVXR
```

```
##
## Attaching package: 'CVXR'
```

```
## The following object is masked from 'package:dplyr':
##
##     id
```

```
## The following object is masked from 'package:purrr':
##
##     is_vector
```

```
## The following object is masked from 'package:stats':
##
##     power
```

```
## Loading required package: nloptr
```

```
names(rslt)
```

```
## [1] "df_pred"        "step1_converge" "step2_converge" "params"
```

```
rslt$df_pred
```

```
## # A tibble: 56 x 3
##    stream     h    pred
##     <int> <dbl>   <dbl>
##  1      1     1  5.48
##  2      1     2 39.3
##  3      1     3 10.5
##  4      1     4 24.2
##  5      2     1 -0.0231
##  6      2     2  0.290
##  7      2     3  0.0211
##  8      2     4 -0.194
##  9      1     5  6.19
## 10      1     6  0.905
## # ... with 46 more rows
```