Variogram function and its applications

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9/20/2020

Variogram function and its applications

```
# Define the variogram function
variogram_func <- function(x, lag) {
  x <- as.matrix(x) # Make sure the x is a vector. It represents the observations of y_t.
  Lag <- NULL
  var_k <- NULL
  vario <- NULL
  for (k in 1:lag) {
    Lag[k] <- k
    var_k[k] <- sd(diff(x, k))^2
    vario[k] <- var_k[k] / var_k[1]
  }
  return(as.data.frame(cbind(Lag, vario)))
}
```

Variograms of chemical process viscosity data (Text: Fig 2.17, page 45)

```
library(readxl)
viscosity <- read_excel("AppendixB_datafile.xls", skip = 2, sheet = "B.3-VISC")
```

```
## New names:
## * `Time Period` -> `Time Period...1`
## * Reading -> Reading...2
## * `Time Period` -> `Time Period...3`
## * Reading -> Reading...4
## * `Time Period` -> `Time Period...5`
## * ...
```

```
readings <- na.omit(c(viscosity$Reading...2, viscosity$Reading...4,
                      viscosity$Reading...6, viscosity$Reading...8))
head(readings)
```

```
## [1] 86.7418 85.3195 84.7355 85.1113 85.1487 84.4775
```

```
class(readings)
```

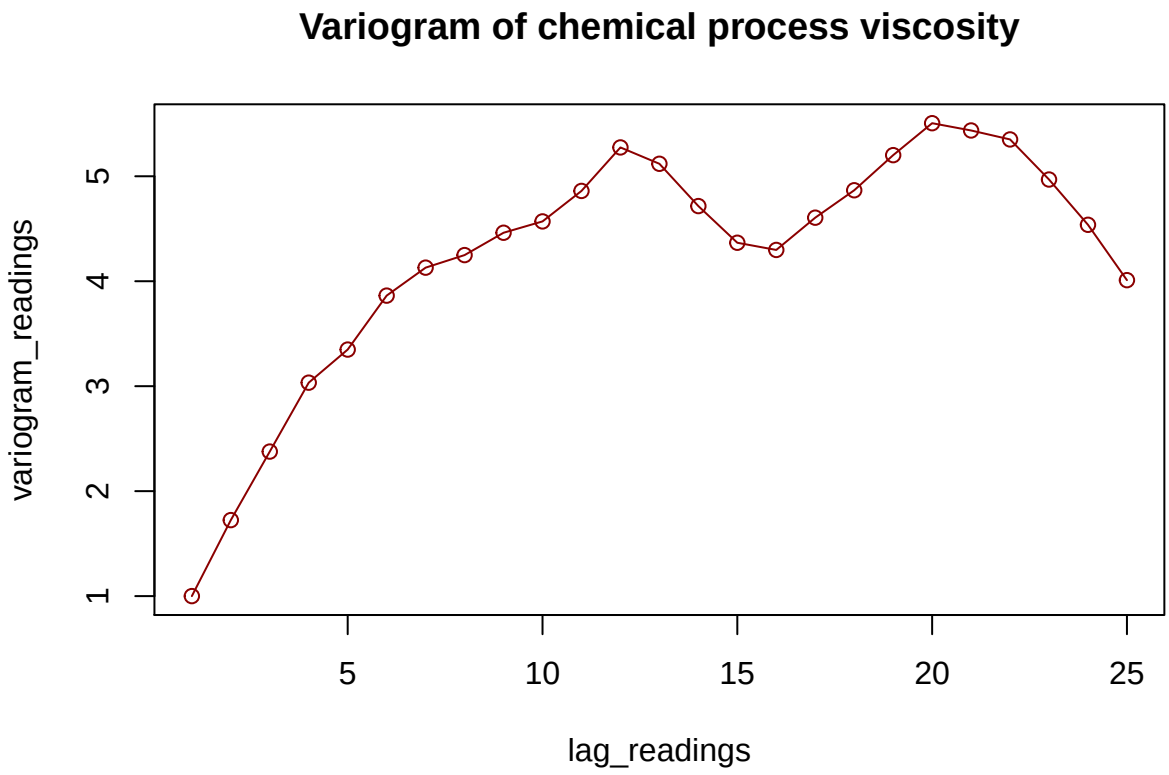
```
## [1] "numeric"
```

```
x <- readings
lag_length <- 25
lag_readings <- 1:lag_length
```

```
z <- variogram_func(x, lag_length)
variogram_readings <- z$vario
variogram_readings
```

```
##  [1] 1.000000 1.723942 2.376856 3.033604 3.348690 3.862875 4.129339 4.248845
##  [9] 4.461848 4.569809 4.860165 5.274703 5.119000 4.715869 4.366605 4.298101
## [17] 4.605405 4.866596 5.201105 5.505501 5.436292 5.350848 4.968960 4.537469
## [25] 4.010016
```

```
plot(lag_readings, variogram_readings, type = "o", col = "dark red",
     main = "Variogram of chemical process viscosity")
```



Variograms of Whole Foods Market stock Price (Text: Fig 2.19, page 46)

```
library(readxl)
stock <- read_excel("AppendixB_datafile.xls", skip = 3, sheet = "B.7-WFMI")
```

```
## New names:
## * Date -> Date...1
## * Dollars -> Dollars...2
## * Date -> Date...3
## * Dollars -> Dollars...4
## * Date -> Date...5
## * ...
```

```r
price <- na.omit(c(stock$Dollars...2, stock$Dollars...4,
                   stock$Dollars...6, stock$Dollars...8, stock$Dollars...10))
head(price)
```

```
## [1] 28.05 28.23 26.25 25.41 26.25 26.03
```

```r
class(price)
```

```
## [1] "numeric"
```

```r
x <- price
lag_length <- 25
lag_stock <- 1:lag_length
z <- variogram_func(x, lag_length)
variogram_stock <- z$vario
variogram_stock
```

```
##  [1]  1.000000  2.139660  3.219850  4.411881  5.583359  6.784479  7.974550
##  [8]  9.102236 10.109781 11.240052 12.378525 13.431489 14.627292 15.821995
## [15] 16.972685 18.123384 19.159940 20.130744 21.074192 21.999525 23.088225
## [22] 24.249945 25.582925 26.749122 27.881126
```

```r
plot(lag_stock, variogram_stock, type = "o", col = "dark red",
     main = "Variogram of stock")
```