GARCH-based regression anomaly detection: This detector estimates a GARCH model to capture conditional heteroskedasticity and flags observations with large standardized residuals as anomalies. A common configuration is sGARCH(1,1) with an ARMA mean. Residuals are summarized and thresholded using harutils().

The GARCH-based detector models conditional heteroskedasticity and flags large standardized residuals as anomalies. We will:

* Load and visualize a sample anomaly dataset
* Configure and run the GARCH detector (hanr\_garch)
* Inspect detections, evaluate, and plot residuals with thresholds

# Install Harbinger (if needed)  
#install.packages("harbinger")

# Load required packages  
library(daltoolbox)  
library(harbinger)

# Load example anomaly datasets  
data(examples\_anomalies)

# Select a simple anomaly dataset  
dataset <- examples\_anomalies$simple  
head(dataset)

## serie event  
## 1 1.0000000 FALSE  
## 2 0.9689124 FALSE  
## 3 0.8775826 FALSE  
## 4 0.7316889 FALSE  
## 5 0.5403023 FALSE  
## 6 0.3153224 FALSE

# Plot the raw time series  
har\_plot(harbinger(), dataset$serie)



# Configure the GARCH-based detector  
model <- hanr\_garch()

# Fit the detector  
model <- fit(model, dataset$serie)

# Run detection to compute residual magnitudes and flags  
detection <- detect(model, dataset$serie)

# Show detected anomaly indices  
print(detection |> dplyr::filter(event == TRUE))

## idx event type  
## 1 50 TRUE anomaly

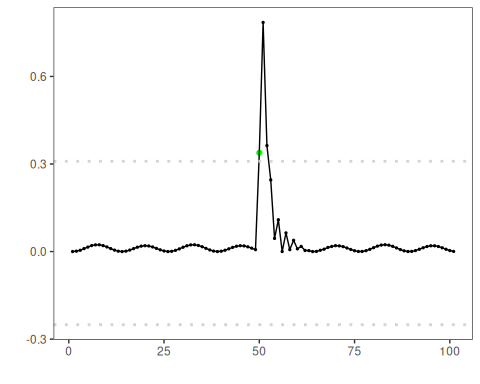
# Evaluate detections against labeled events  
evaluation <- evaluate(model, detection$event, dataset$event)  
print(evaluation$confMatrix)

## event   
## detection TRUE FALSE  
## TRUE 1 0   
## FALSE 0 100

# Plot detections vs. ground truth  
har\_plot(model, dataset$serie, detection, dataset$event)



# Plot residual magnitude and decision thresholds  
har\_plot(model, attr(detection, "res"), detection, dataset$event, yline = attr(detection, "threshold"))



References - Engle, R. F. (1982). Autoregressive Conditional Heteroscedasticity with Estimates of the Variance of United Kingdom Inflation. Econometrica, 50(4), 987–1007. - Bollerslev, T. (1986). Generalized Autoregressive Conditional Heteroskedasticity. Journal of Econometrics, 31(3), 307–327.