Wavelet regression anomaly detection: Multi-resolution analysis via MODWT wavelet decomposition; detail coefficients are aggregated to form a magnitude signal. Large localized energy indicates anomalies, with thresholding via harutils().

The wavelet-based detector decomposes the series into multi-resolution detail bands (MODWT) and flags large aggregated high-frequency energy as anomalies. Steps:

* Load and visualize a simple anomaly dataset
* Configure and run hanr\_wavelet
* Inspect detections, evaluate, and plot residual magnitudes and 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 wavelet-based detector  
model <- hanr\_wavelet()

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

# Run detection  
detection <- detect(model, dataset$serie)

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

## idx event type  
## 1 50 TRUE anomaly

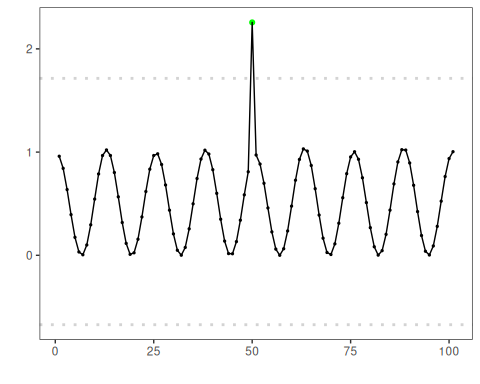
# Evaluate detections against labels  
evaluation <- evaluate(model, detection$event, dataset$event)  
print(evaluation$confMatrix)

## 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 - Mallat, S. (1989). A theory for multiresolution signal decomposition: The wavelet representation. IEEE TPAMI, 11(7), 674–693.