Overview and objectives: SoftED provides soft evaluation by matching detections to ground truth within tolerance windows and assigning partial credit. This notebook shows how to compute both hard and soft metrics and when soft evaluation is more appropriate (e.g., temporal uncertainty around event onset).

# 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 a simple MLP regressor-based anomaly detector  
model <- hanr\_ml(ts\_mlp(ts\_norm\_gminmax(), input\_size = 5, size = 3, decay = 0))

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

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

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

## idx event type  
## 1 50 TRUE anomaly

# Hard evaluation  
evaluation <- evaluate(model, detection$event, dataset$event, evaluation = har\_eval())  
print(evaluation$confMatrix)

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

# Soft evaluation (SoftED) with tolerance window sw\_size = 5  
result <- evaluate(model, detection$event, dataset$event, evaluation = har\_eval\_soft(sw\_size = 5))  
print(result$confMatrix)

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

# Evaluation can also be performed directly without a model object  
result <- evaluate(har\_eval\_soft(sw\_size = 5), detection$event, dataset$event)  
print(result$confMatrix)

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

References - Salles, R., Lima, J., Reis, M., Coutinho, R., Pacitti, E., Masseglia, F., Akbarinia, R., Chen, C., Garibaldi, J., Porto, F., Ogasawara, E. (2024). SoftED: Metrics for soft evaluation of time series event detection. Computers and Industrial Engineering. <doi:10.1016/j.cie.2024.110728>