Automated Anomaly Detection in Large Sequences

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19 Décembre 2024

Introduction and context

Classical anomaly detection methods rely on comparing a subsequence to each other subsequence in the time-series. It raises problems when facing :

- Large time-series
- Repeated anomalies

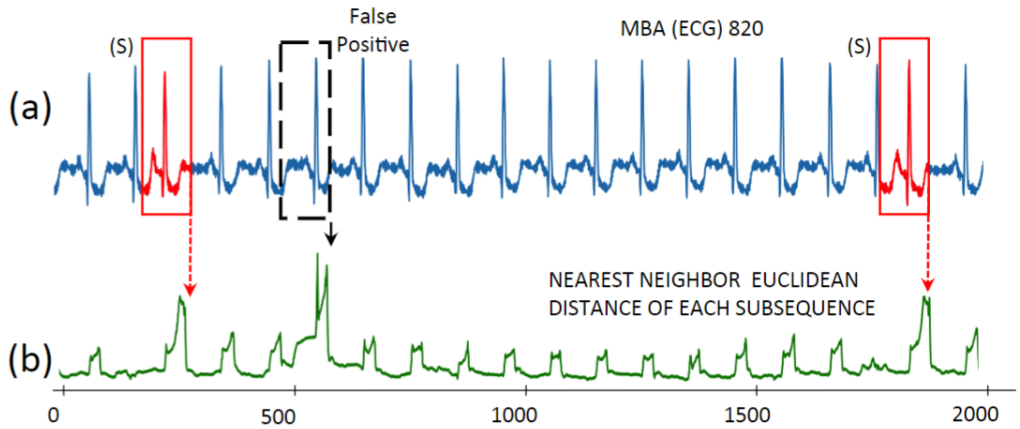

Figure – Heartbeats with several anomalies

Method

The article introduces a new method to perform anomaly detection in large time series, which relies on the introduction of a "normal behaviour" of the time series.

Construction of N_M

- Randomly select subsequences of length $3 \times l$
- Hierarchical clustering of the subsequences
- Select the cluster c that maximises
  $N(c) = \frac{frequency(c)^2 \times coverage(c)}{\Sigma_{x \in \mathbb{C}} dist(center(c), center(x))}$

Idea : The normal cluster is the one that is the most frequent and the most central.

Method

Outliers detection :

For each subsequence of size l in the time series :

- Compute the distances to all subsequences of size l in N_M.
- Label as anomalies the k sequences with the largest distance to M_N, or the one that are above a certain threshold.