Kernel Based Approaches for Change-Point Detection — Report 1

Anirudhan J. Rajagopalan, ajr619

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1 Offline Detection

1.1 Univariate Detection

Lets assume a time series of observations $x_1, x_2, \ldots, x_n$ of independent random variables with parameters $(\mu_1, \sigma_1^2), (\mu_2, \sigma_2^2), \ldots, (\mu_n, \sigma_n^2)$. Also lets assume that each of the observation x_i is normally distributed with mean μ and common variance $\sigma^2 \forall i \in 1, 2, \ldots, n$. When there is no change in mean, the hypothesis of stability (null hypothesis) is defined as

$$H_0 : \mu_1 = \mu_2 = \cdots = \mu_n = \mu \tag{1}$$

Lets suppose that there is a change in the mean in the observations at an unknown point K. This can be define dy

$$H_1 : \mu_1 = \ldots \mu_k \neq \mu_{k+1} \ldots = \mu_n \tag{2}$$

In our experiments we are going to assume that we know μ_1, μ_n and σ are known beforehand (Refer 2.1.1 of [1]).

1.1.1 Experiments

Finding the likelihood directly using the likelihood function is not practical as it is not computationally tractable for even a small value of n (600 in our case). So we follow the steps given in the reference[1] to find the change point.

The offline changepoint detection problem, gives a pretty accurate value for changepoint at k = 300. The different plots are as displayed below.

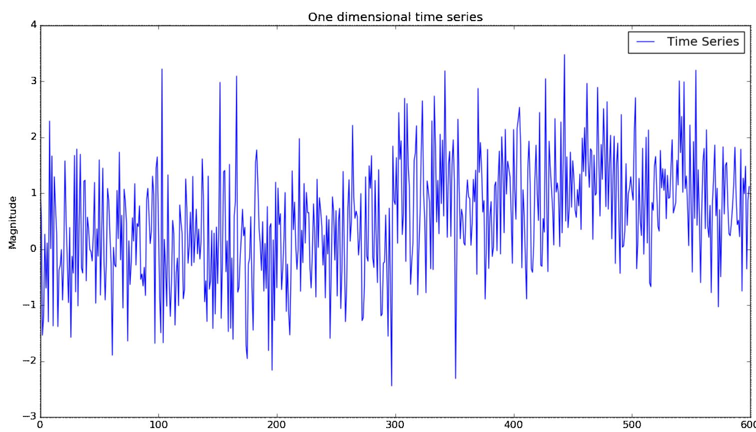

Figure 1: One dimensional time series.

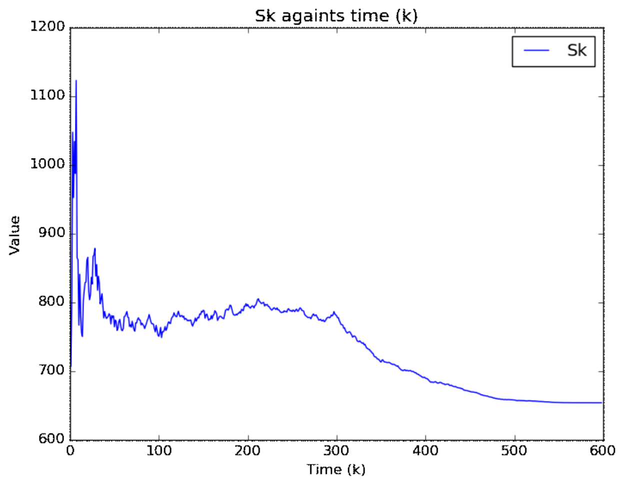

Figure 2: SK values for one dimensional offline detection problem.

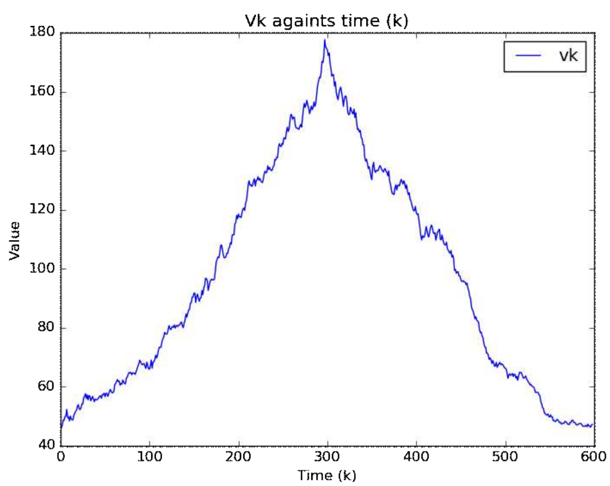

Figure 3: VK values for one dimensional offline detection problem.

1.2 Multi-variate Detection

2 Online Detection

References

[1] Jie Chen and Arjun K. Gupta. *Parametric Stastical Change Point Analysis - With applications to Genetics, Medicine and Finance*. Birkhauser, 2012.