

# ScilabSignalCorrelation

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## Problem

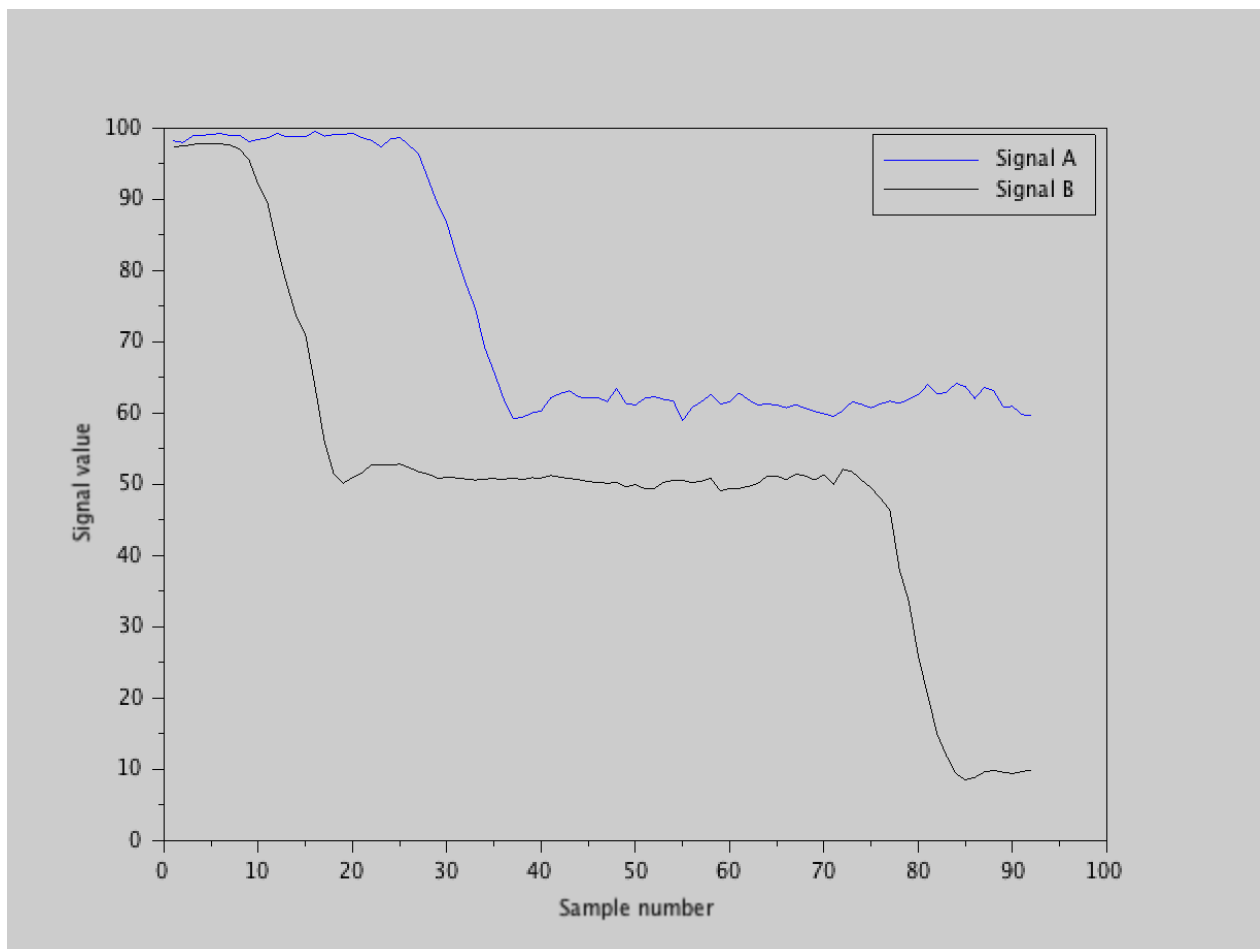
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How to determine the time delay between two records of the same signal ?

The typical example is :

- John moves his hand
- Kinect 1 records John --> signal A
- Kinect 2 records John --> signal B
- Kinect 1 and 2 are not time synchronised.

The situation is as follows :



In the previous figure we see that:

- there is an offset between the two signals, and a small difference in scale
- both signals show a drop

- the "drops" in A and B should occur at the same time
- if we "slide" signal B to the right (later in time) we get the best correspondance when the "drops" align, when B is sled of `Delay` samples.

Starting form the situation in the previous figure, we can rephrase the problem :

- we seek for the `delay` that maximises the co-occurence in time of the **changes** in A and the **changes** in B

## Solution

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Because it the *same* signal that is recorded with two different sensors:

- the frequency content of A and B is the same (except for some noise, that is supposed to be white => we can forget it safely).
- the scaling of A and B is similar (we do not need to rescale one signal)

Hence, we can use *cross correlation* between A and B to determine the time lag.

Yet, because we do not want that A overlaps B, but we want that the **changes** in A and B are synchronised, we run `xcorr` on `dA` and `dB` , where :

- `dA` = changes in A
- `dB` = changes in B

The code uses the fuction `xcorr` from scilab : [documentation for xcorr](#)

```
function [delay, lags, c] = getDelayBetweenSignals(A, B)
    dA = diff(A);           // differences in A (approx time derivative)
    dB = diff(B);
    [c, lags] = xcorr(dA, dB); // cross correlation of the derivatives
    [val, iVal] = max(c)      // find index of max correlation
    delay = lags(iVal)        // the delay is at the max of the correlati
endfunction
```

Running this code with the input in the previous figure, we get :

On the previous figure, we see that the maximum correlation between `dA` and `dA` is for a lag of

## Result

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After identification of the `delay` , we obtain the following :

## Usage

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- (Clone or) download the repository
- On your computer :
  - Open `main.sce` with scilab editor (SciNotes)
  - Run the script (press F5, or click the button with a triangle)

## Notes :

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- You first need to install [Scilab](#)...
- Double click on `main.sce` might not work... depending on your OS.  
Opening files from SciNotes allways works (File menu -> open).
- *Do not modify the names and organisation of the directories*  
The DAT+PRG+RES structure is expected when initialising in `InitTRT.sce`