Tik-61.181 Special Course in Information Science I, autumn 1997

Project work

The project work is done using Matlab. In the work, there are four different noisy signals originating from a (real!) industrial process. Your task is to filter each of the four signals – according to instructions below – with three different filters. In each case, two filters are given (see table 1), and the third one you may choose freely. Note that you should not use any filter twice in the work.

Filtering instructions for signals:

- Signal 1. Remove the noise there where the signal level is constant; the signal edges should be preserved.
- Signal 2. Smooth the signal so that the small local variations disappear. The two large signal peaks should not be very heavily damped.
- Signal 3. Remove the sharp impulses. The small local signal variations should be preserved (at least to some extent).
- Signal 4. Filter out the local regular waveform of the signal by heavily smoothing the signal.

Signal	Filter 1	Filter 2	Filter 3
1	(r,s)-fold Wisorized mean	FIR median hybrid	your choice
2	impulse detecting	average controlled local average	-"-
3	selective average	selective median	-"-
4	LUM smoother	Wilcoxon	-"-

Table 1: Filters to be used in the filtering of signals.

What you should do for each signal:

1. Implement the three filters using Matlab.
2. Filter the signal using the three filters. Try several different filter parameters (window length and possibly something else) to find those which best meet the given specifications.
3. Compare the filtering results with each other. This can be done, for instance, by subtracting two filtering results and inspecting the resulting signal and/or by plotting all the results and the original signal into same figure. Analyze, how the filters behave (well or poorly) for the signal and why.

Write a brief report including your filter implementations (Matlab `m`-files), plots of filtered signals and your conclusions about the results. The report should be returned by **January 31st 1998** to course assistant Esa Alhoniemi (room F415 in the Laboratory of information and computer science).

Some instructions

Matlab

Matlab is available (at least) in the workstations in Maarintalo. If you use it elsewhere, note that the basic Matlab package is sufficient for the work – no toolboxes are needed.

How to get the signals?

Go to the web page of the course `http://www.cis.hut.fi/cis/edu/Tik-61.181/` The signals file `signals.mat` can be obtained via link `Signals` on the page. Save the signals into your home directory using your web browser. (In Netscape, for instance, this can be done so that move your mouse pointer on the `Signals` link, press right mouse button, and choose `Save link as...` option from the pop-up menu.)

The signals can be loaded to Matlab using command `load signals`. After this, you have four variables (700-point vectors) `signal1...signal4` in your workspace, which you can verify using command `whos`.

Problems?

If you have something to ask about Matlab or the project work, please contact course assistant Esa Alhoniemi (email `esa.alhoniemi@iki.fi`).