Lesson 1: Introduction, Median Filtering

Nonlinear Signal Processing – SS 2019

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Session contents

- Course logistics
- Short intro: Median vs. mean filtering

Course Logistics (1)

- We'll have about eight meetings → up-to-date information in TUGonline (here or in HS i12, attendance is not mandatory)

1. 15.03.2018, 09:15-10:45, Lernzentrum Lehrsaal 1
2. 05.04.2018, 09:15-10:45, Lernzentrum Lehrsaal 1
3. 03.05.2018, 09:15-10:45, HSi12
4. 10.05.2018, 09:15-10:45, HSi12
5. 24.05.2018, 09:15-10:45, Lernzentrum Lehrsaal 1
6. 07.06.2018, 09:15-10:45, Lernzentrum Lehrsaal 1
7. 14.06.2018, 09:15-10:45, Lernzentrum Lehrsaal 1
8. 28.06.2018, 09:15-10:45, Lernzentrum Lehrsaal 1

- Will be updated throughout the semester

Course Logistics (2)

- Information sources:
  - Course homepage (handouts, matlab files, . . .)

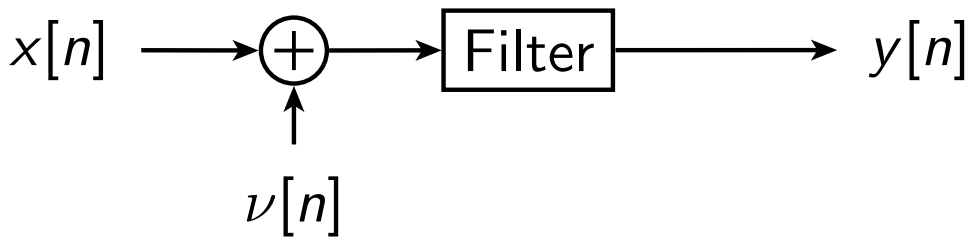
    `http://www.spsc.tugraz.at/courses/nonlinearsignalprocessing`
  - Newsgroup:`tu-graz.lv.nl-signalprocessing`
- One handout per major topic block (Intro, Static NL, Fading-memory NL, NL dynamical systems)
- Contain problems to be solved together in class
- Also contain homework problems (marked with a house icon)

Course Logistics (3)

- You are encouraged to work in pairs (just one report per pair has to be handed in!)
- You have to hand in a report *at the end of the semester*
- You *may* hand in seperate reports to get intermediate grading
- Contains **results, plots, discussion, interpretation** for *homework* problems
- Deadline is TBA/TBD
- Mail all your Matlab files to me
- Basis for grading is the report

Intro: Mean vs. Median filtering

- For both filters: Consider data samples within a window
- Mean: Compute (sliding) average of samples $\rightarrow$ linear
- Median: Replace current sample by median within window $\rightarrow$ non-linear



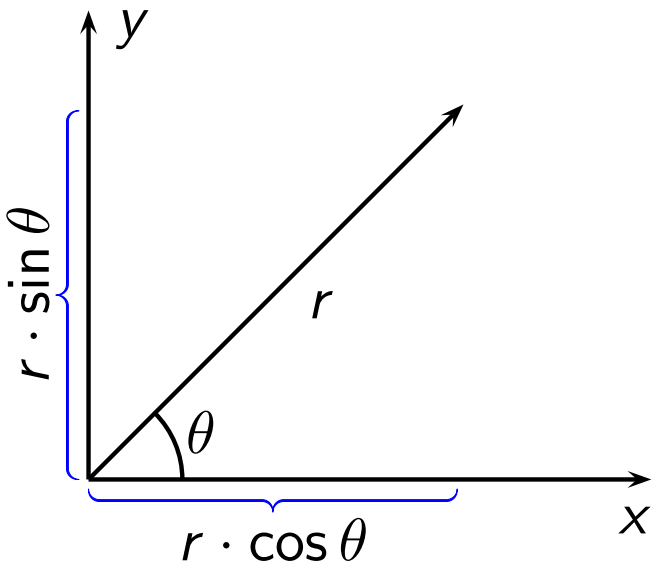
$$\text{SNR} = 10 \log_{10} \frac{\sum_n \text{signal}^2[n]}{\sum_n \text{noise}^2[n]}$$

$\rightarrow$ Compute a SNR_{in} as well as a SNR_{out}!

$\rightarrow$ What is noise$[n]$ before/after the filter?

Nonlinear Transformations – Problem 1.4

- Problem 1.4: A first glance at a nonlinear transformation



- Sensor measures range r and angle θ to a target
- Estimate the position in Cartesian coordinates
- What do we expect? What happens if sensor values are noisy?