during Idoodi

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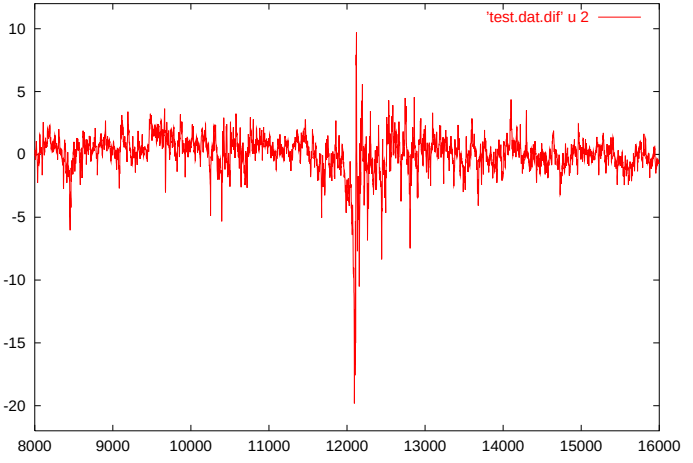
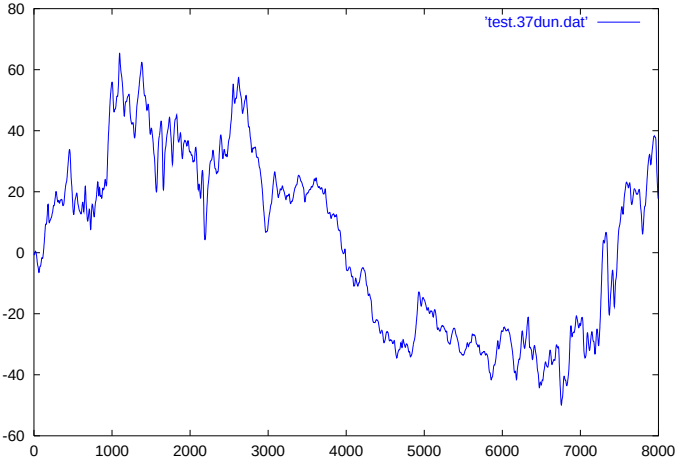
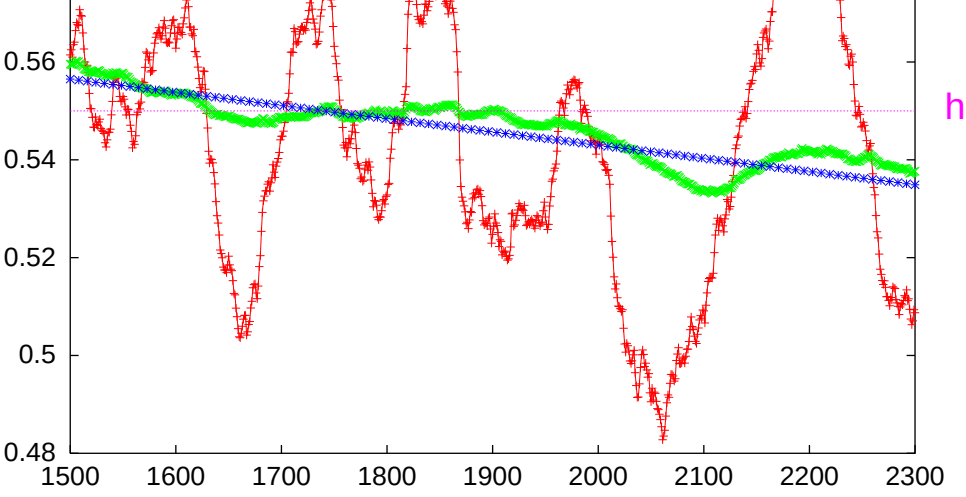


fetal heartrate??



financial time series??

- Breaking with the universality picture *in favour of:*
  i) local view
  ii) complex intereactions with the envoronment
- Towards a fetal surveillance system
- Can lessons be learned for economy decision support?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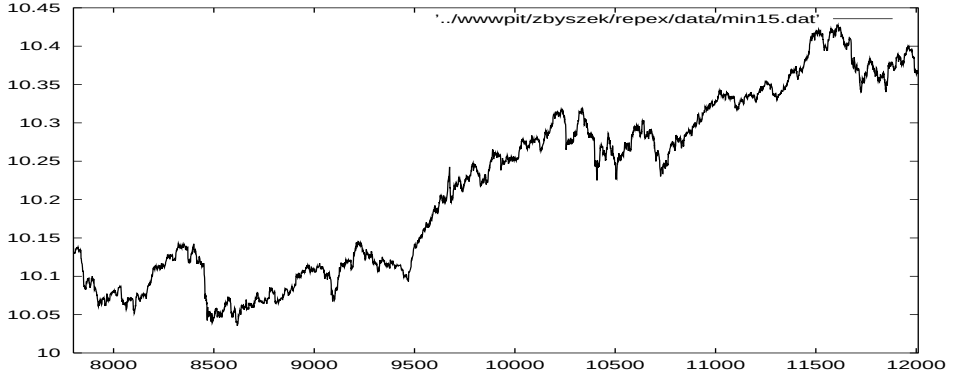
0.54
0.52
0.5
0.48
1500
1600
1700
1800
1900
2000
2100
2200
2300

h(BW)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10.3
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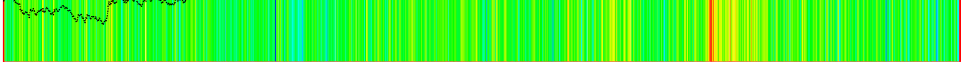
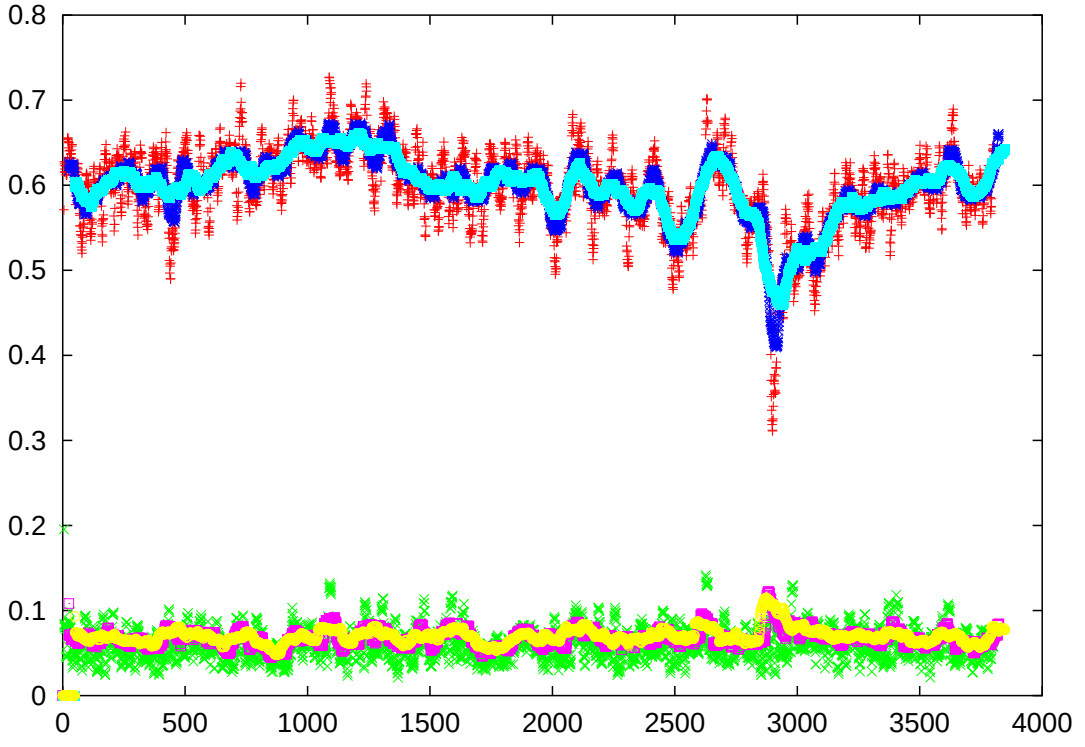
12000



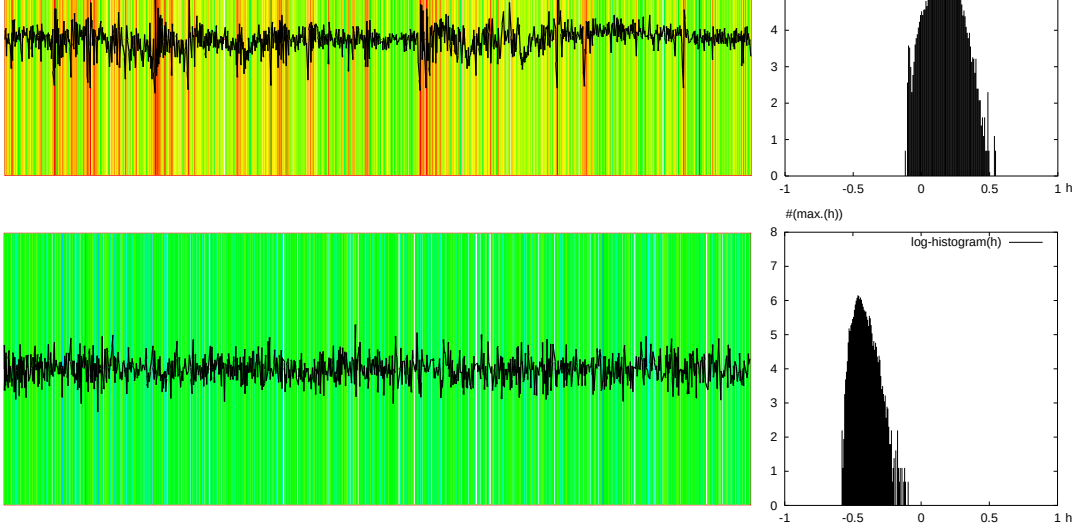
- volatitily increase
- increase in (anti-)correlations ($H \leq -0.5$)
- increase of multifractal spectrum width



- multiscale crashes (and 'rallies') constitute the stock index
- the question we ask is whether the economy remains 'healthy'

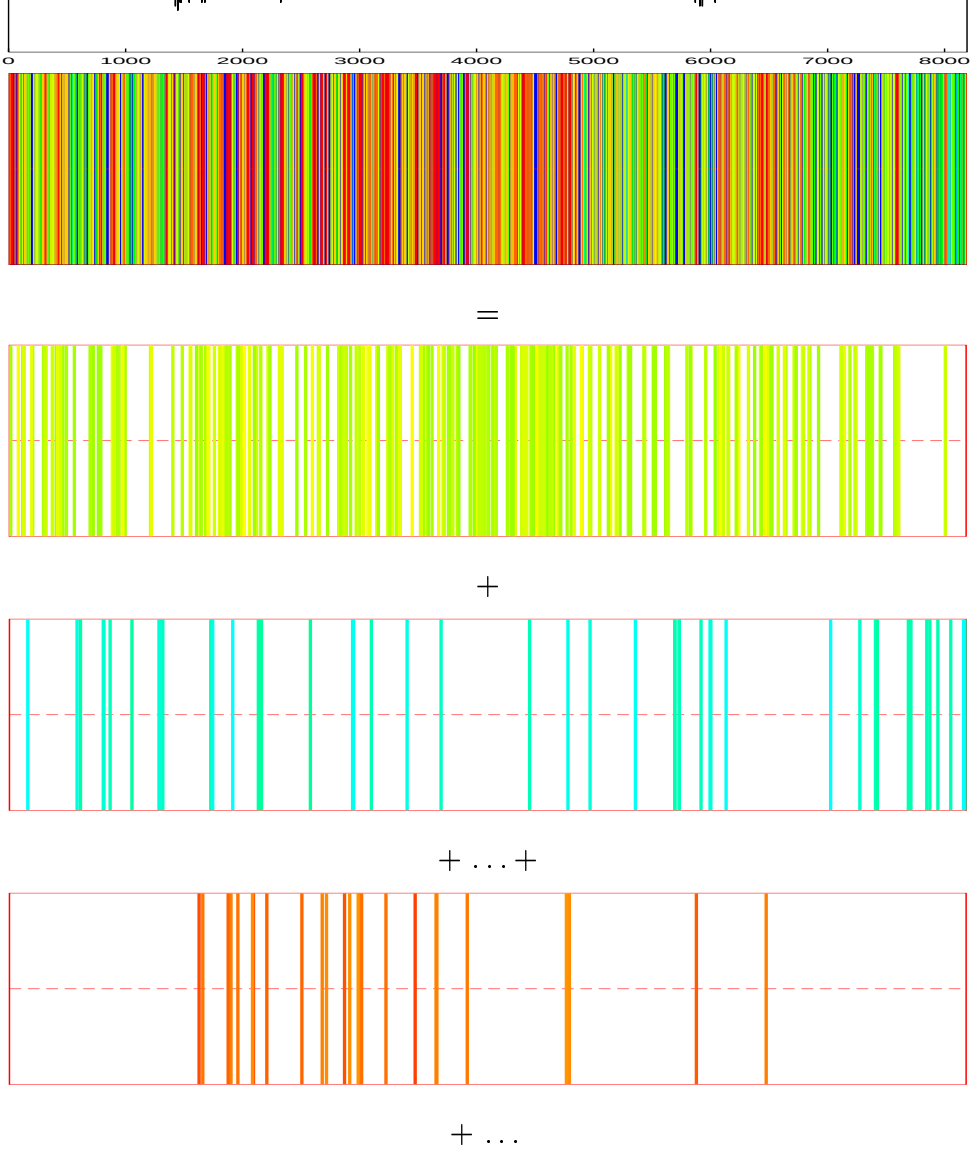
$$|f(x) - P_n(x - x_0)| \leq C|x - x_0|^{h(x_0)}.$$

- We can be tempted to extract $h(x_0)$ from the scaling of the wavelet transform $Wf(x_0, s)$.

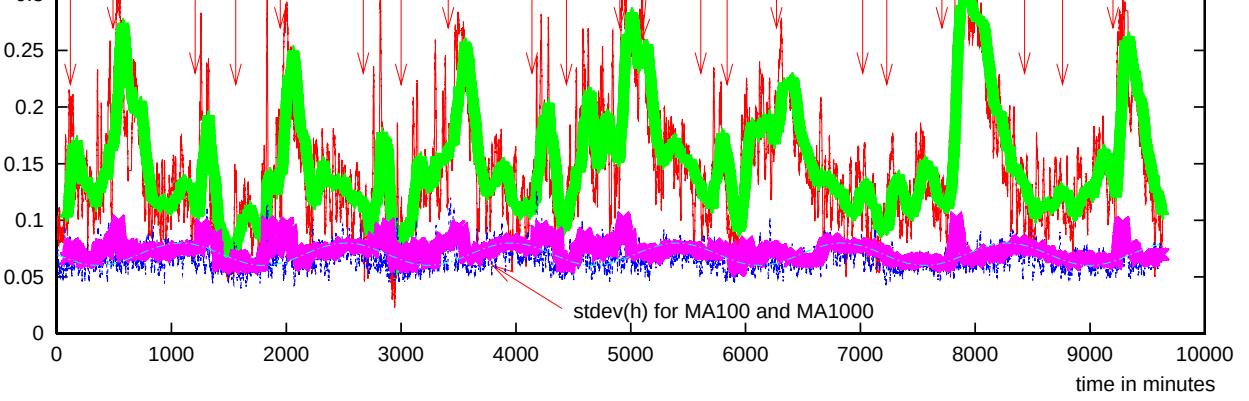


Local contributions to the 'traditional' multifractal spectra

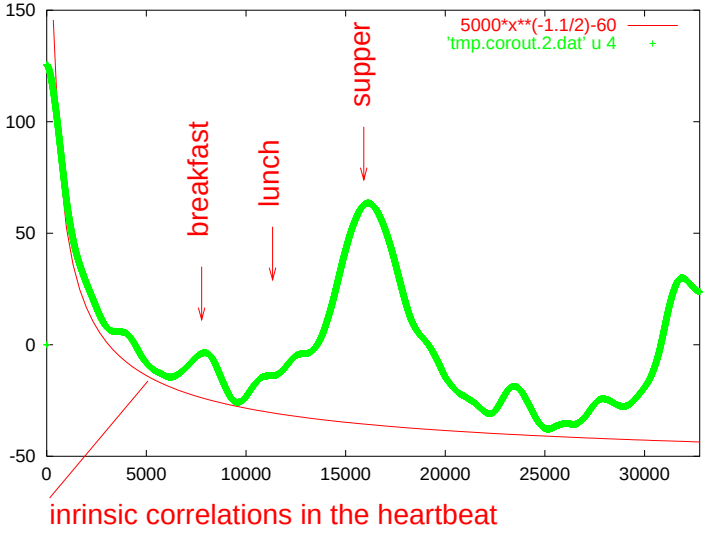
- Healthy heartbeat interbeat intervals and white noise
- Multifractal process vs monofractal noise



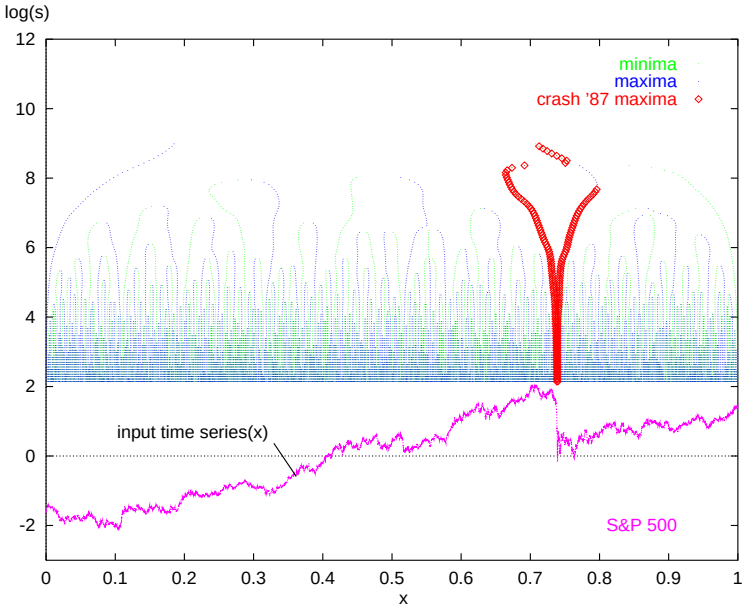
- With all its monochromatic, *i.e.* *mono-fractal*, components separable!



- Link to the external temporal information reveals structure!



- Autocorrelation function confirms the presence of invariant, intra-day periodic structure.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8
6
4
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-2
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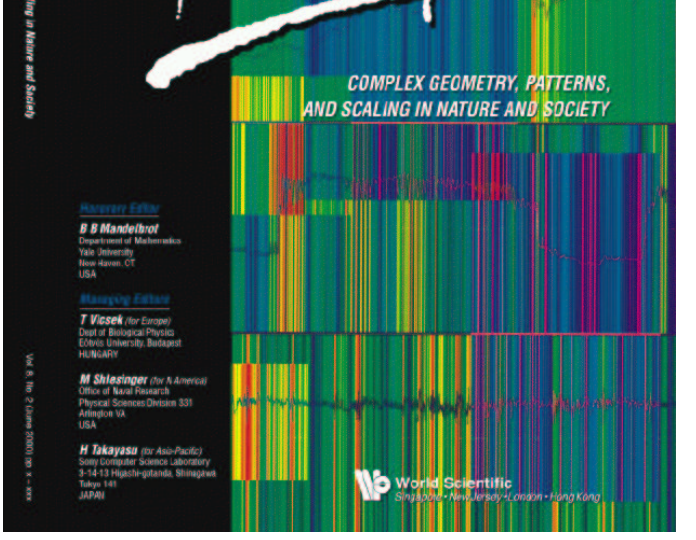
0.6
0.7
0.8
0.9
1
x
minima
maxima
crash '87 maxima
input time series(x)
S&P 500


COMPLEX GEOMETRY, PATTERNS,
AND SCALING IN NATURE AND SOCIETY
World Scientific


COMPLEX GEOMETRY, PATTERNS,
AND SCALING IN NATURE AND SOCIETY
B B Mandelbrot
Department of Mathematics
Yale University
New Haven, CT
USA
T Vicsek (for Europe)
Dept of Biological Physics
Eötvös University, Budapest
HUNGARY
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Arlington VA
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Sony Computer Science Laboratory
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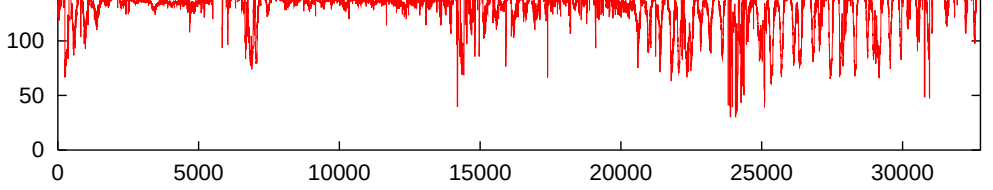
Tokyo 141
JAPAN
World Scientific
Singapore • New Jersey • London • Hong Kong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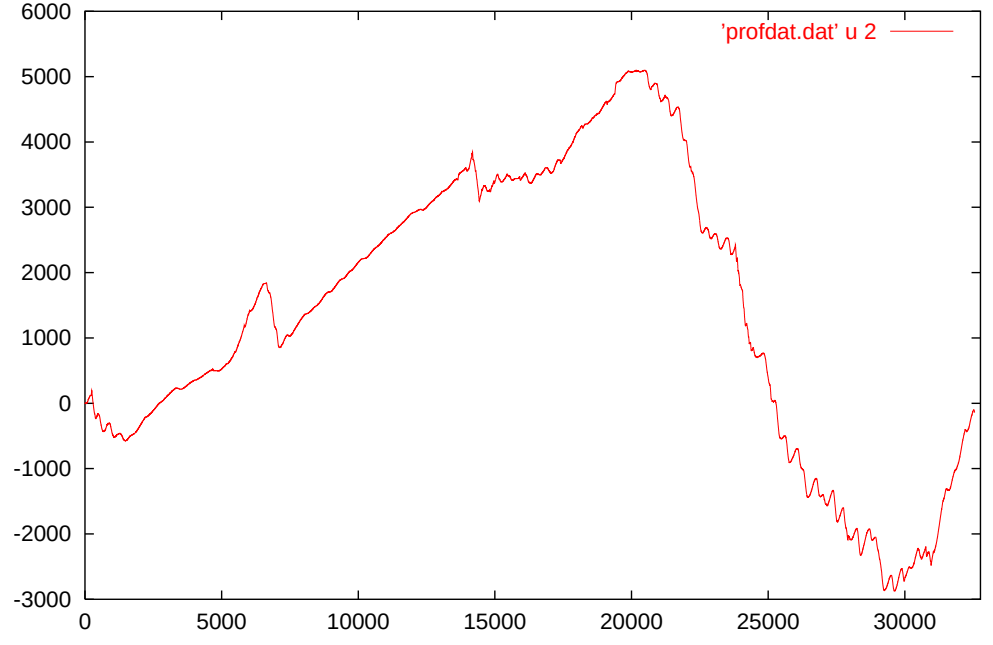
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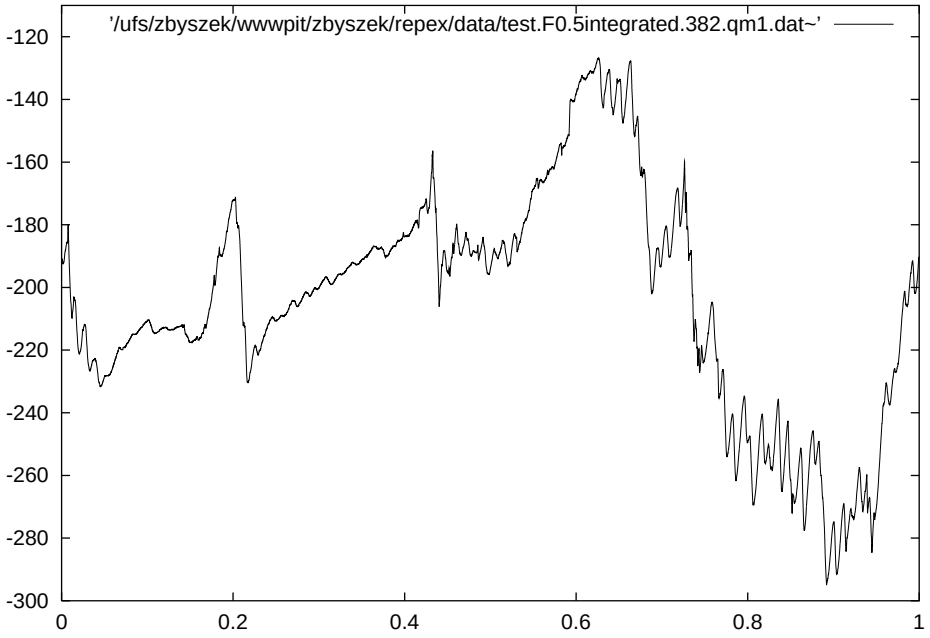
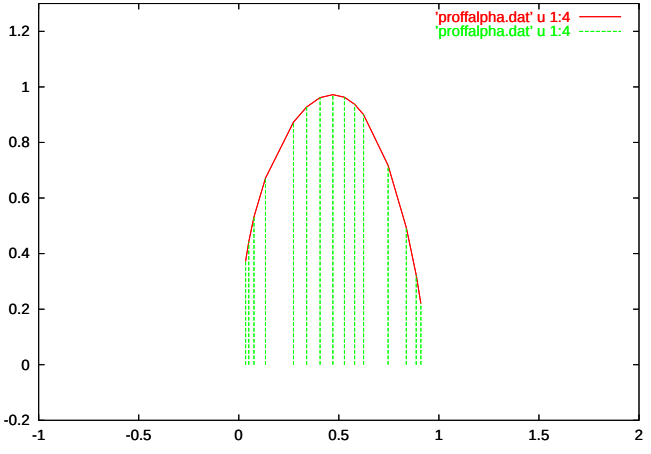
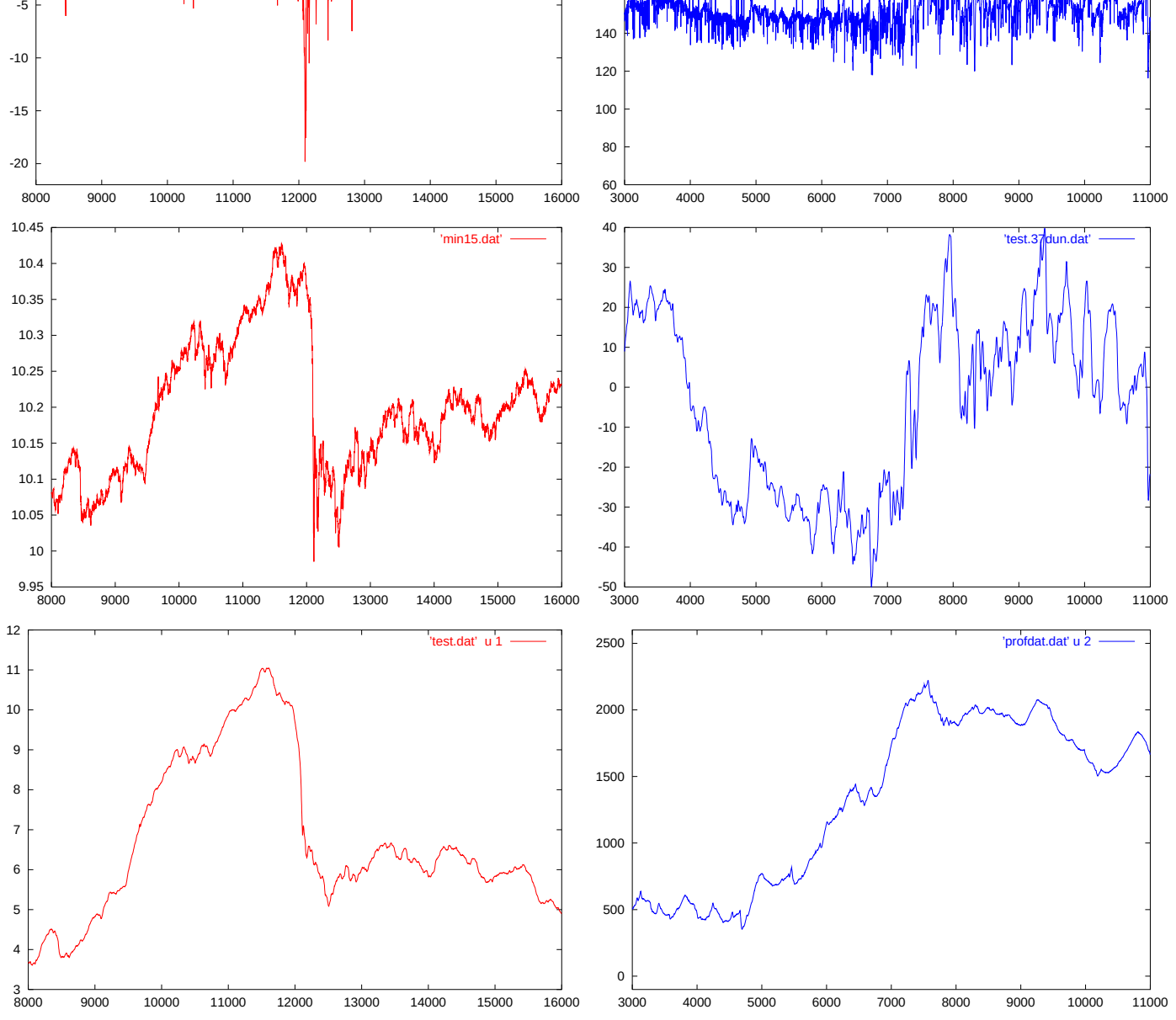


Fractionally integrated fetal heartbeat record

- full multifractal spectrum
- centred at $H = 0.5$

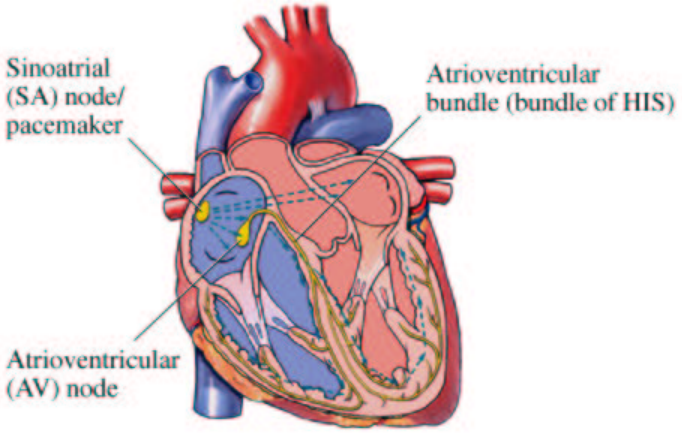




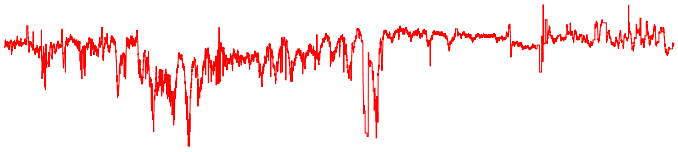
Fractional Integration

- Order of 10-100 degrees of freedom

- Degree of supply of oxygen driven (good or bad news...)



Conduction system of the heart

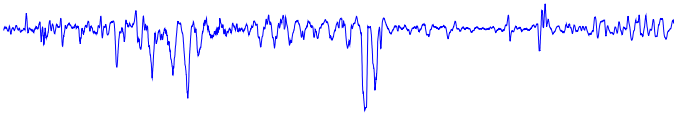


=

- Baseline

+

- Acc-/decelerations



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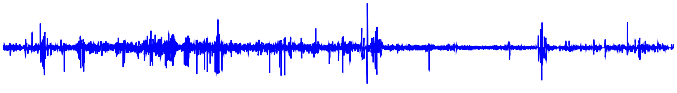
- Variability



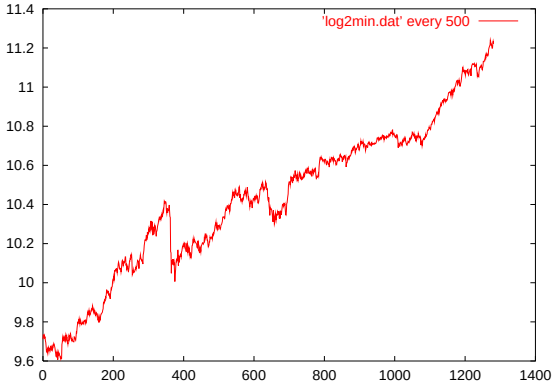
(To be) suggested for use in obsetrics decision making:

- Variability correlation and 'multifractality' level after the 'crash'
- 'Speed' of recovery from the 'crash'

- Order of 1.000-10.000 degrees of freedom

- Good or bad news driven...

Dow down —Trader Aram Adler reacts near the close of trading in the Dow Jones futures pit ... AP



Not yet suggested for use in economics decision making:

- Variability, correlation and 'multifractality' level after the 'crash'
- 'Speed' of recovery from the 'crash'

  - fetal heartbeat needs to be monitored in real time
  - standard (multi-)fractal characteristics fail dramatically

- Proposed solution:
  - running, real-time decomposition scheme
  - separating meaningful components of fetal heartbeat
  - constructing meaningful real-time indicators - e.g. cumulative h
  - consulting additional information in a Bayesian belief network

- In collaboration with

Wim J. van Wijngaarden

Academic Medical Centre (AMC), Amsterdam

  - number of stillbirths
  - gestational age at delivery
  - drugs to stimulate contractions
  - biochemical variabels
  - Apgars scores
  - ...

- For monitoring
- For prediction

- In collaboration with

Robert Castelo

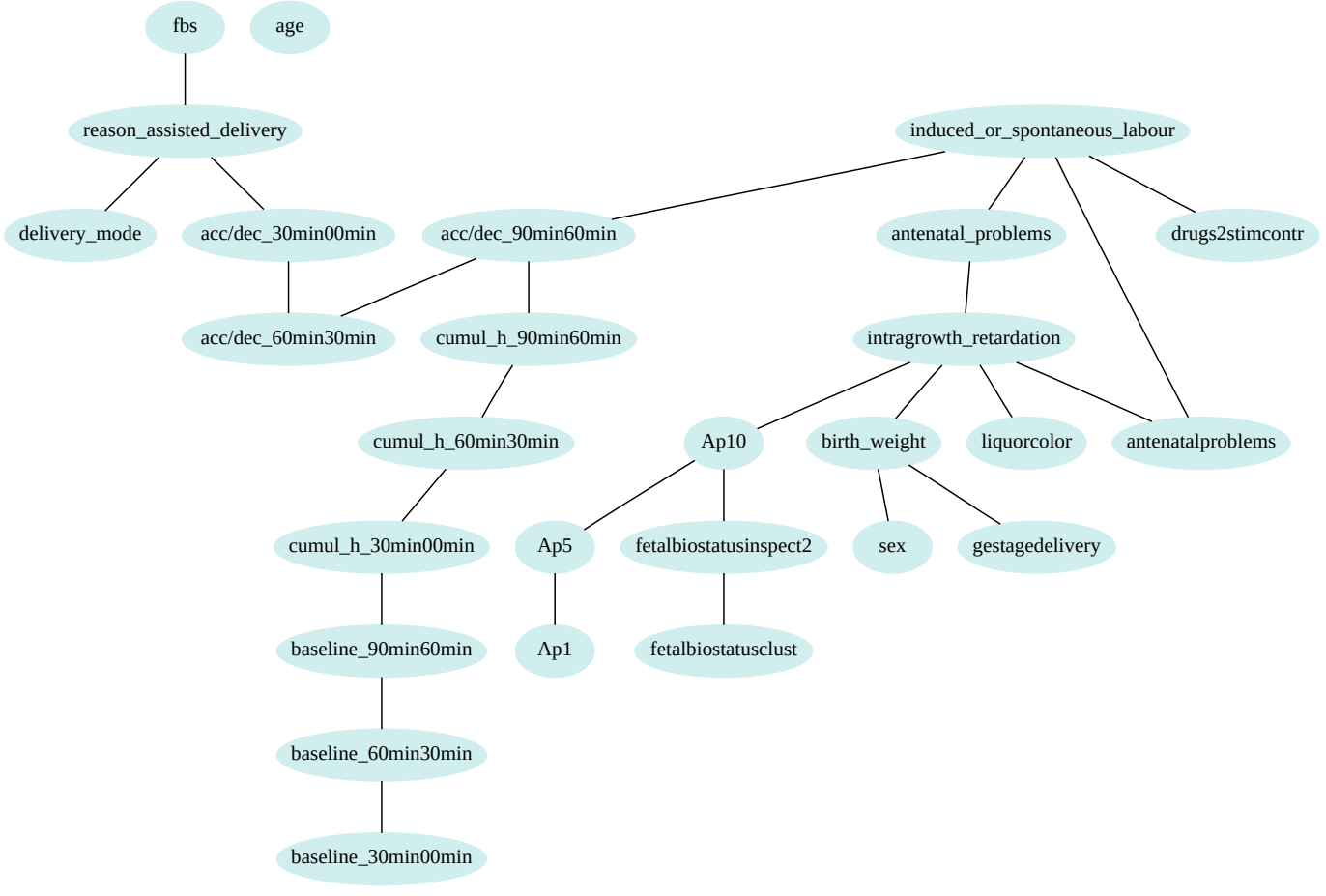
Utrecht University

-it can be used to learn (causal) relationships

-and hence to gain understanding about a problem domain

-and to predict the consequences of intervention

- it is ideal for representing prior knowledge and data



- Simplified version of the best dependence network

- Using Bayesian belief networks, we have captured the basics of the obstretrics reasoning process

- The exact nature of correlations between the temporal features and fetal outcome has still to be determined

- A possible improved functional relation with more predictive power and physiologial foundation (to replace cumulative h) will be sought for