Workshop

Deconvolution Analysis of EDA data with Ledalab

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EDA Analysis Software: Ledalab

- "Leipzig EDA Laboratory"
- Matlab software
- Developed by Christian Kaernbach (V1) & Mathias Benedek (V2, V3)
  - V1: Curve fitting of 20 s segments using Bateman function (Gradient descent, tonic)
  - V2: Curve fitting of entire data set (windowing, fix tau)
  - V3.0: Decomposition by Nonnegative Deconvolution
  - V3.1: Continuous Decomposition added
  - V3.2: ISCR added
- Available at www.ledalab.de (GNU General Public License)

Main Features

- Data Import
- Data Viewer
- Preprocessing
- Analysis (DDA, CDA)
- Results Export (ERA)
- Batch-mode

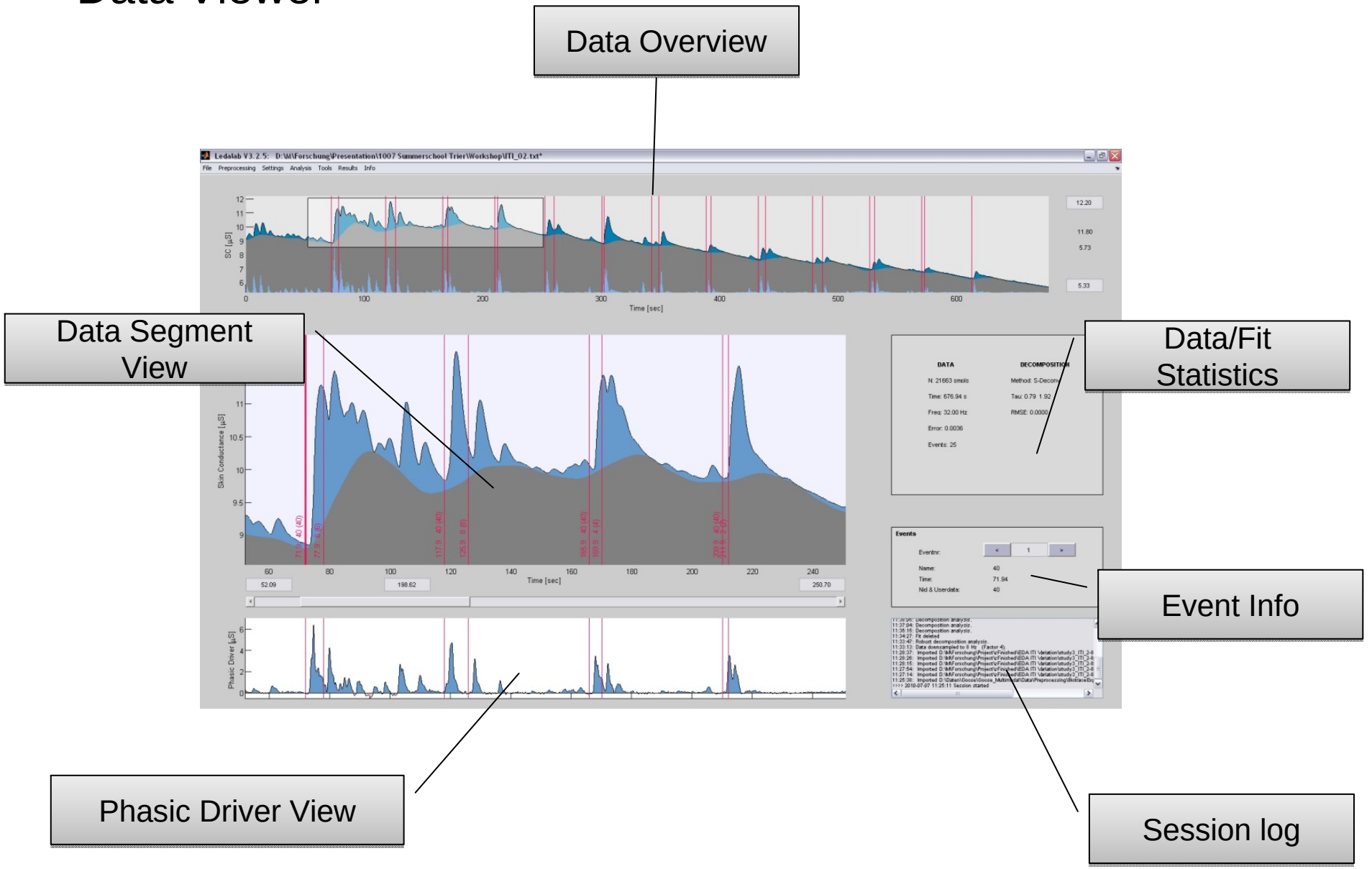
Data Import

- Load/Import data
  - BioPac (to be included)
  - BioTrace (Text Export)
  - CassyLab (*.lab)
  - Ledalab (*.mat)
  - PortLab (Text Export)
  - PsychLab (Text Export)
  - VarioPort (*.vpd)
  - VisionAnalyzer (Matlab Export)
  - VitaPort (Text Export)

  - Further options:
    - Text data files
    - Matlab data files
    - BioSig ToolBox

- Import event data

Data Viewer


Data Overview
Data Segment View
Data/Fit Statistics
Event Info
Phasic Driver View
Session log

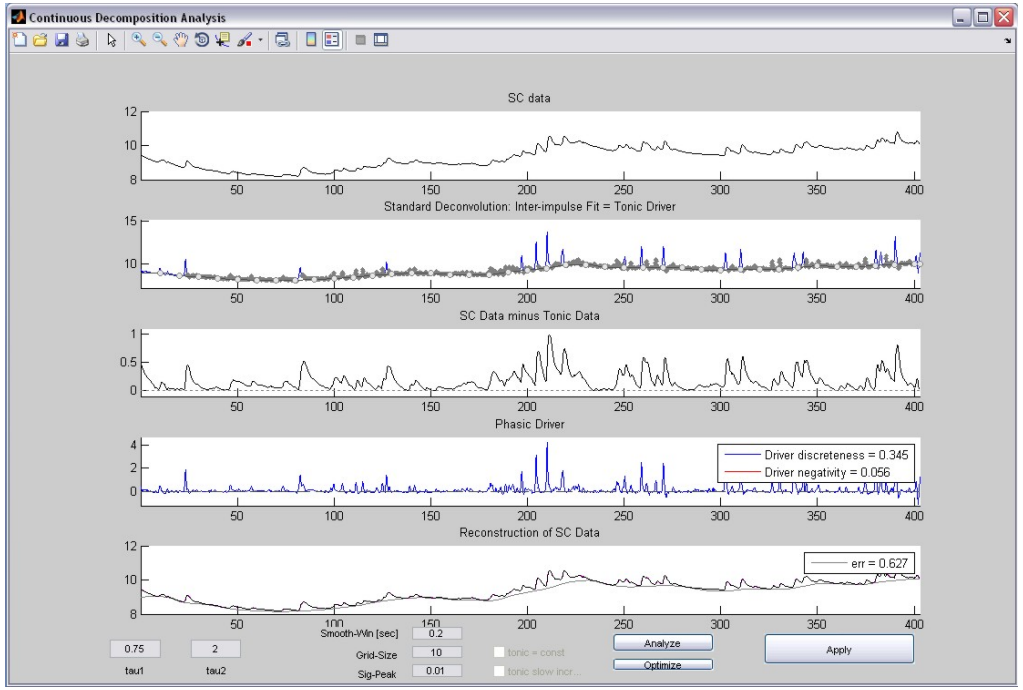
Preprocessing functions

- Cut data
- Downsampling
- Manual/adaptive data smoothing
- Filter
- Artifact correction (manual)

Analysis

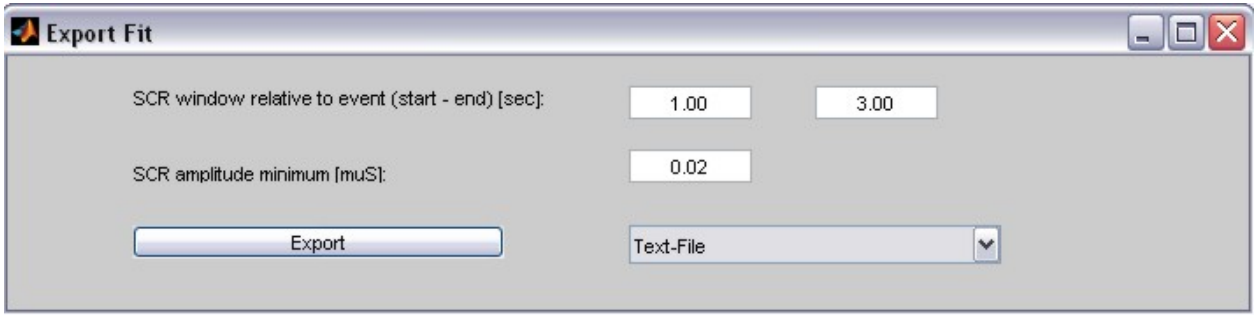
- Methods:
  - Continuous Decomposition Analysis
    Decomposition into continuous tonic and phasic signals
    Efficient analysis, recommended for most purposes.
  - Discrete Decomposition Analysis (Nonnegative Deconvolution)
    Decomposition into discrete tonic and phasic components
  - Min-max analysis (trough-to-peak): always included

- Steps:
  - Run analysis
  - Optimize analysis
  - Apply to data



Results Export

- Export event-related activation to Êxcel/Text/Matlab file
- Many indicators of phasic and tonic activity (see online documentation)



	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Event-Nr	Event-NId	Event-Name	SCR [muS]	ISCR [muSxs]	PhasicMax [muS]	SCR_ITTP [muS]	Tonic [muS]	nSCR_ttp	AmpSum_ttp [muS]	Onset1_ttp [s]	Mean [muS]	MaxDeflection [muS]
2	1	40	40	2,4030	7,2090	5,0691	1,0351	7,9656	1	0,9535	1,3125	8,2852	0,7750
3	2	2	2	0,6788	2,0365	4,9776	0,4356	7,9543	0	0,0000		8,8470	0,7120
4	3	40	40	1,6024	4,8071	3,6044	0,6936	8,7565	1	0,6403	1,5000	9,0691	0,6160
5	4	4	4	0,1784	0,5352	0,4162	0,0781	8,7446	0	0,0000		9,3109	0,0000
6	5	40	40	1,4086	4,2257	3,1301	0,6100	8,6138	1	0,6037	1,7500	8,7766	0,4940
7	6	8	8	0,6010	1,8030	1,5095	0,2608	8,6084	1	0,1347	2,4688	8,8850	0,1230
8	7	40	40	0,3018	0,9055	0,6538	0,1312	8,2553	1	0,1453	2,5000	8,3370	0,0760
9	8	6	6	0,6857	2,0570	1,4008	0,2953	8,2805	1	0,2442	2,1875	8,4912	0,1830
10	9	40	40	0,1750	0,5250	0,4997	0,0771	8,2041	1	0,0919	2,5313	8,2266	0,0520
11	10	4	4	0,3046	0,9138	0,5775	0,1305	8,2061	1	0,1062	2,3125	8,3186	0,0810
12	11	40	40	0,4668	1,4005	1,0668	0,2025	7,9188	1	0,2567	2,2500	7,9869	0,1320
13	12	8	8	0,0807	0,2422	0,1711	0,0334	7,9370	0	0,0000		8,1527	0,0010
14	13	40	40	0,2128	0,6385	0,2935	0,0880	7,8478	0	0,0000		8,2862	0,0020
15	14	6	6	0,0480	0,1441	0,1229	0,0202	7,8974	0	0,0000		8,0735	0,0010
16	15	40	40	0,1409	0,4228	0,2894	0,0600	7,5873	1	0,0431	2,8438	7,6380	0,0170
17	16	2	2	0,1892	0,5675	0,2851	0,0784	7,5686	0	0,0000		7,6530	0,0390
18	17	40	40	0,0755	0,2264	0,1803	0,0316	7,3240	0	0,0000		7,3648	0,0010
19	18	4	4	0,0579	0,1736	0,1306	0,0240	7,2884	0	0,0000		7,3441	0,0010
20	19	40	40	0,1073	0,3219	0,2100	0,0454	6,9086	1	0,0132	2,4375	6,9727	0,0110
21	20	2	2	0,0922	0,2766	0,1551	0,0380	6,9016	0	0,0000		6,9786	0,0110
22	21	40	40	0,0871	0,2614	0,1810	0,0371	6,6391	0	0,0000		6,6923	0,0090
23	22	6	6	1,7010	5,1031	4,1411	0,7332	6,6164	1	0,7818	1,6250	6,9254	0,6710
24	23	40	40	0,0392	0,1176	0,1363	0,0176	7,7544	0	0,0000		7,7898	0,0070
25	24	8	8	0,0000	0,0000	0,2015	0,0000	7,7221	0	0,0000		7,7428	0,0020
26	25	40	40	0,2588	0,7765	0,5001	0,1085	7,2457	1	0,0580	1,4688	7,3589	0,0590
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Direct access to data/analysis

Command Window

```
>> global leda2
>> leda2.data
ans =
          events: [1x1 struct]
     conductance: [1x1 struct]
            time: [1x1 struct]
               N: 6447
    samplingrate: 16
>> leda2.data.events.event(1)
ans =
        time: 22.3125
         nid: 99
        name: '99'
    userdata: []
>> leda2.analysis
ans =
                tau: [0.7500 2]
          smoothwin: 0.2000
      tonicGridSize: 10
             driver: [1x6447 double]
        tonicDriver: [1x6447 double]
          remainder: [1x6447 double]
             kernel: [1x272 double]
         phasicData: [1x6447 double]
          tonicData: [1x6447 double]
    phasicDriverRaw: [1x6447 double]
              error: [1x1 struct]
             method: 'sdeco'
fx >>
```

Command line batch-analysis

- Run Ledalab form Command Window
- Analysis all files in folder
- Import/analysis/export

```
Command Window
>> Ledalab('D:\Daten\Workshop','open','biotrace','downsample',2,'analyze',2,'optimize',2,'export_era',[1 4 .01])

17:30:12: Starting Ledalab batch for D:\Daten\Workshop\ (10 file/s)

17:30:12: Batch-Analyzing ITI_01.txt
Optimized parameter:  2.41   4.03    Error:  0.722 (Initial parameter:  0.75     2.00    Error:  3.715)
Optimized parameter:  1.85   5.20    Error:  0.738 (Initial parameter:  0.75     4.00    Error:  1.871)
Final optimized parameter:   2.41     4.03   Error:  0.722

17:30:27: Batch-Analyzing ITI_02.txt
Optimized parameter:  0.77   1.94    Error:  0.619 (Initial parameter:  0.75     2.00    Error:  0.626)
Optimized parameter:  0.78   1.93    Error:  0.618 (Initial parameter:  0.75     4.00    Error:  1.062)
Final optimized parameter:   0.78     1.93   Error:  0.618

17:30:36: Batch-Analyzing ITI_03.txt
Optimized parameter:  0.61   0.66    Error:  0.397 (Initial parameter:  0.75     2.00    Error:  2.955)
Optimized parameter:  0.52   0.74    Error:  0.397 (Initial parameter:  0.75     4.00    Error:  7.396)
Final optimized parameter:   0.52     0.74   Error:  0.397

17:30:44: Batch-Analyzing ITI_04.txt
Optimized parameter:  0.54   2.00    Error:  1.087 (Initial parameter:  0.75     2.00    Error:  1.340)
Optimized parameter:  0.45   2.27    Error:  1.118 (Initial parameter:  0.75     4.00    Error:  3.237)
Final optimized parameter:   0.54     2.00   Error:  1.087

17:30:51: Batch-Analyzing ITI_05.txt
```