

功能性近紅外光定量分析

fNIRS Quantitative Analysis

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本週課程內容

- fNIRS analysis package: HOMER2
 - <http://www.nmr.mgh.harvard.edu/PMI/resources/homer2/home.htm>
- HOMER Processed Data (*.nirs)
- Quantitative Analysis

Please download the materials_L13.zip from
http://www.ym.edu.tw/~cflu/CFLu_course_fnirs.html

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HOMER資料內容

HOMER Processed Data

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Raw Data for HOMER2

- MATLAB mat-file format (*.nirs)
- SD: source/detector geometry
- d: dual-wavelength raw signals for all channels
- s: event time points
- t: time axis in second
- ml: lists of source-detector channels
- aux: auxiliary signal



Name ^	Value
SD	1x1 struct
aux	10446x1 double
d	10446x28 double
ml	28x4 double
s	10446x3 double
t	10446x1 double

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Processed Data from HOMER2

- **MATLAB mat-file format (*.nirs)**
 - `load('.\data\Subj01.nirs','-mat')`
- **procInput:**
 - Employed functions and parameters
- **procResult:**
 - Processed signals and parameters
- **tIncMan:**
 - Manually excluded time interval

Name ^	Value
SD	1x1 struct
aux	10446x1 double
d	10446x28 double
ml	28x4 double
procInput	1x1 struct
procResult	1x1 struct
s	10446x3 double
t	10446x1 double
tIncMan	10446x1 double
userdata	1x1 struct

ProcResult (1/2)

- **dod:** optical density signals
 - data length x (channels x 2 wavelengths)
- **dc:** Hb concentration signals
 - data length x Hb components (HbO, HbR, Hbtotal) x channels
- **dcAvg:** block averages of Hb signals
 - Block length x Hb components x channels x conditions
- **dcAvgStd:** STD of block averages
 - Block length x Hb components x channels x conditions

Field ^	Value
dod	10446x28 double
dc	10446x3x14 double
dodAvg	[]
dcAvg	4-D double
dodAvgStd	[]
dcAvgStd	4-D double
dodSum2	[]
dcSum2	4-D double
tHRF	1x509 double
nTrials	[3,3,3]
SD	[]
tIncAuto	10446x1 double
tIncChAuto	10446x28 double

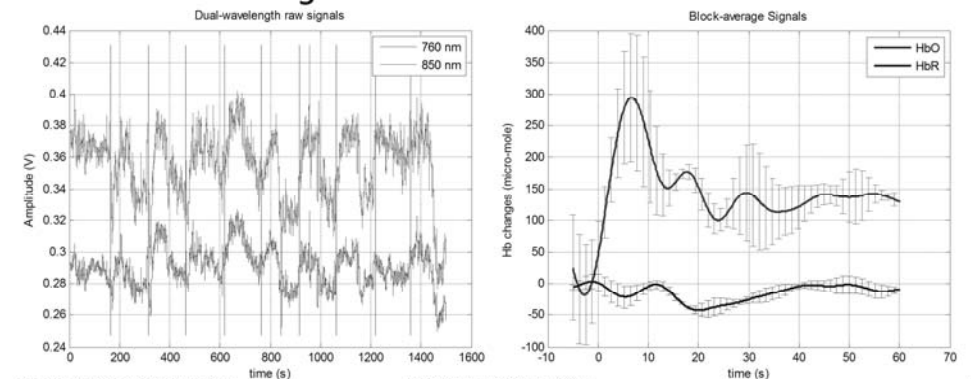
ProcResult (2/2)

- **tHRF:** time axis (in second) of block
 - 1 x Block length
- **nTrials:** number of each condition
 - 1 x conditions
- **tIncAuto:** excluded time interval
 - Data length x 1
- **tIncChAuto:** excluded time interval for each channel
 - Data length x (channel x 2 wavelengths)

Field ^	Value
dod	10446x28 double
dc	10446x3x14 double
dodAvg	[]
dcAvg	4-D double
dodAvgStd	[]
dcAvgStd	4-D double
dodSum2	[]
dcSum2	4-D double
tHRF	1x509 double
nTrials	[3,3,3]
SD	[]
tIncAuto	10446x1 double
tIncChAuto	10446x28 double

Plot Signals from *.nirs

- Please run **PlotSigNIRS.m** and load a *.nirs file

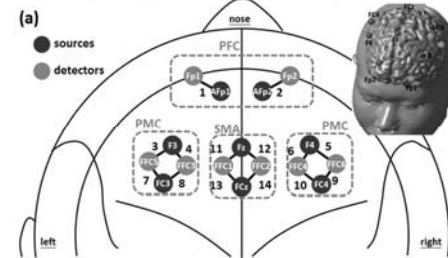


定量分析 fNIRS Quantitative Analysis

Example Dataset

- 10 subject processed files in the downloaded data folder
- 14 channels, 3 conditions (60 s)

1. Normal-pace walking (NW)
2. Walking while performing a cognitive task (WCT)
3. Walking while performing a motor task (WMT)



名稱	修改日期	類型
Subj01.nirs	2015/5/28 上午 0...	NIRS 檔案
Subj02.nirs	2015/5/27 下午 1...	NIRS 檔案
Subj03.nirs	2015/5/27 下午 1...	NIRS 檔案
Subj04.nirs	2015/5/27 下午 1...	NIRS 檔案
Subj05.nirs	2015/5/27 下午 1...	NIRS 檔案
Subj06.nirs	2015/5/27 下午 1...	NIRS 檔案
Subj07.nirs	2015/5/27 下午 1...	NIRS 檔案
Subj08.nirs	2015/5/27 下午 1...	NIRS 檔案
Subj09.nirs	2015/5/27 下午 1...	NIRS 檔案
Subj10.nirs	2015/5/27 下午 1...	NIRS 檔案

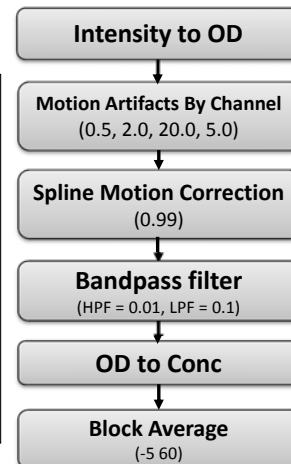
Processing flow

- CV calculation

The rejection thresholds are:
 CVchannel > 15%
 CVtrial > 10%
 The group averaged CVstandstill_w1 = 1.44%, CVstandstill_w2 = 1.93%

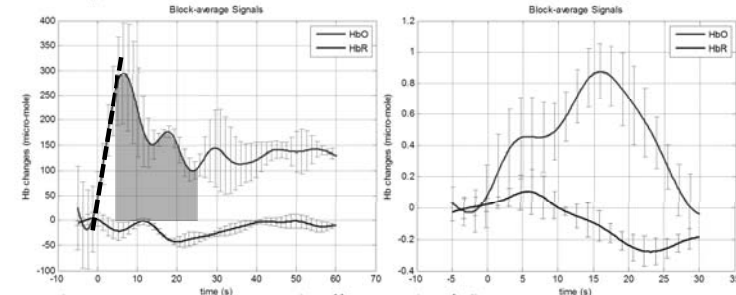
The channels have to be rejected based on criteria are listed as belows,
 [Subject #1]: Subj01.nirs
 Channel #7 S5-D3, CVchannel_w1 = 38.78%, CVchannel_w2 = 35.13%
 Channel #8 S5-D5, CVchannel_w1 = 38.29%, CVchannel_w2 = 35.36%
 [Subject #8]: Subj08.nirs
 Channel #5 S4-D4, CVchannel_w1 = 24.14%, CVchannel_w2 = 14.09%

The trials have to be rejected based on criteria are listed as belows,
 [Subject #1]: Subj01.nirs
 Channel #8 S5-D5, Trial #4, CVtrial_w1 = 8.69%, CVtrial_w2 = 10.02%
 [Subject #8]: Subj08.nirs
 Channel #5 S4-D4, Trial #2, CVtrial_w1 = 16.04%, CVtrial_w2 = 10.43%
 Channel #5 S4-D4, Trial #4, CVtrial_w1 = 39.86%, CVtrial_w2 = 18.58%
 Channel #5 S4-D4, Trial #8, CVtrial_w1 = 19.59%, CVtrial_w2 = 12.52%
 Channel #5 S4-D4, Trial #9, CVtrial_w1 = 39.73%, CVtrial_w2 = 12.74%



Quantitative Analysis

- Signal mean (SM) during task block (within the period of 5~25 s)
- Area under curve during task block (within the period of 5~25 s)
- Signal slope (SS) within first 2~7 seconds during task block



Quantitative Analysis

- Please run **QuanAnalysis_excel.m**
 - Load *.nirs files in the selected folder
 - Plot mean signals for each channel and condition
 - Calculate values of interest
 - SM, Area under curve, SS
 - Output results into Excel files



Data Output to Excel files

- Output data

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1		1	2	3	4	5	6	7	8	9	10	11	12	13	14
2	Subj #1	-2.21647	-0.39298	-8.45542	-8.89339	-6.10277	-11.295	-8.59166	-14.7985	4.35418	-7.0636	-5.1188	-2.8265	-2.86812	-1.65084
3	Subj #2	14.63425	19.51131	11.85311	6.734553	14.4422	12.53427	11.61112	9.287581	13.28279	26.14657	9.355034	9.062778	15.84364	13.7941
4	Subj #3	6.880832	8.639391	-15.0624	17.29997	11.7926	9.971544	19.19651	27.41524	4.886163	6.419013	6.735763	3.951636	17.07166	23.60687
5	Subj #4	13.41732	2.299837	16.75914	12.3058	10.43942	4.847504	12.11043	15.7653	11.09249	17.44522	8.113566	7.290436	11.31536	10.56169
6	Subj #5	24.89119	10.82365	12.45225	17.05715	2.933162	15.3594	12.9121	26.45349	8.916727	14.54892	16.32959	11.90317	20.22203	15.16636
7	Subj #6	22.30749	24.70315	-3.193	2.03729	-10.4835	9.794145	-0.13395	0.641702	2.549545	-4.46562	-0.99295	4.48382	-1.62093	-0.4104
8	Subj #7	35.53937	13.13692	9.915779	7.899169	13.95014	16.61813	3.006788	-2.90131	11.66749	16.17623	14.19464	12.79333	22.12574	17.29086
9	Subj #8	11.37175	13.25997	15.51856	14.00349	0.831987	8.441872	14.43075	17.59827	3.829416	8.449655	14.73077	11.69119	10.9844	8.321469
10	Subj #9	12.52891	6.058982	4.186033	2.055845	5.618188	-0.11519	4.964649	7.773187	-1.8205	-5.68195	9.057805	1.035922	1.168613	-1.03605
11	Subj #10	27.90544	15.59226	30.94456	30.60464	21.33821	19.7701	47.18935	49.73234	36.38593	59.20849	40.26558	32.38032	30.98159	32.44865
		NW_Avg	WCT_Avg	WMT_Avg	NW_Area	WCT_Area	WMT_Area	NW_Slope	WCT_Slope	WMT_Slope					

THE END

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