Human fMRI project

2022. 11. 08

설재민

1. Subject summary

a. 16 subjects 사용 가능(10 good / 6 bad perform.)

b. 나머지 17 subjects는 fMRI data가 없거나 부족

2. Behavior data

a. Timestamp별 position head direction data 없어서,
UDK log로부터 trial parsing 다시 해야 함

b. MR signal timstamp는 있음

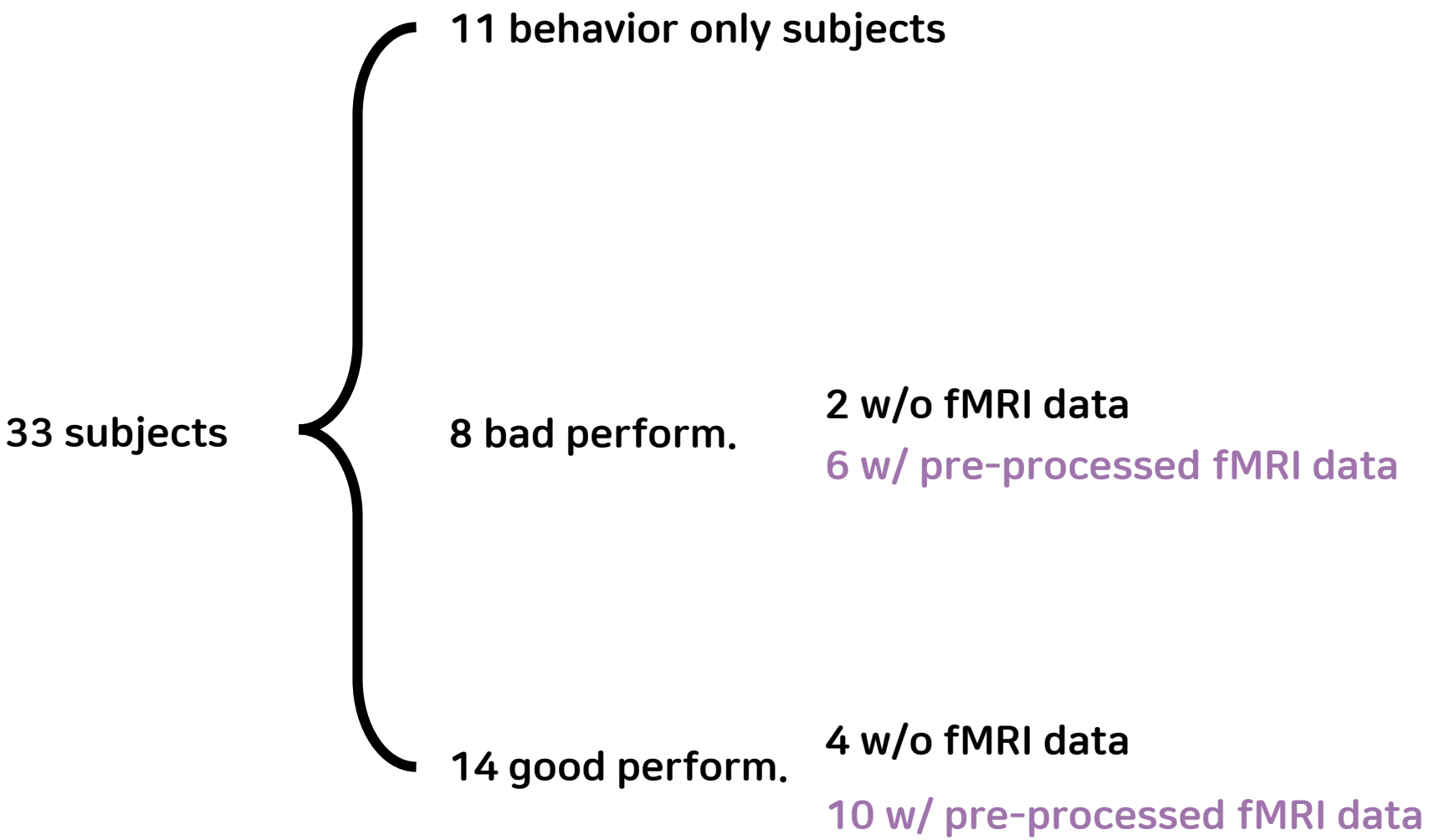
3. MR data

a. SPM 사용하여 MR image processing 필요

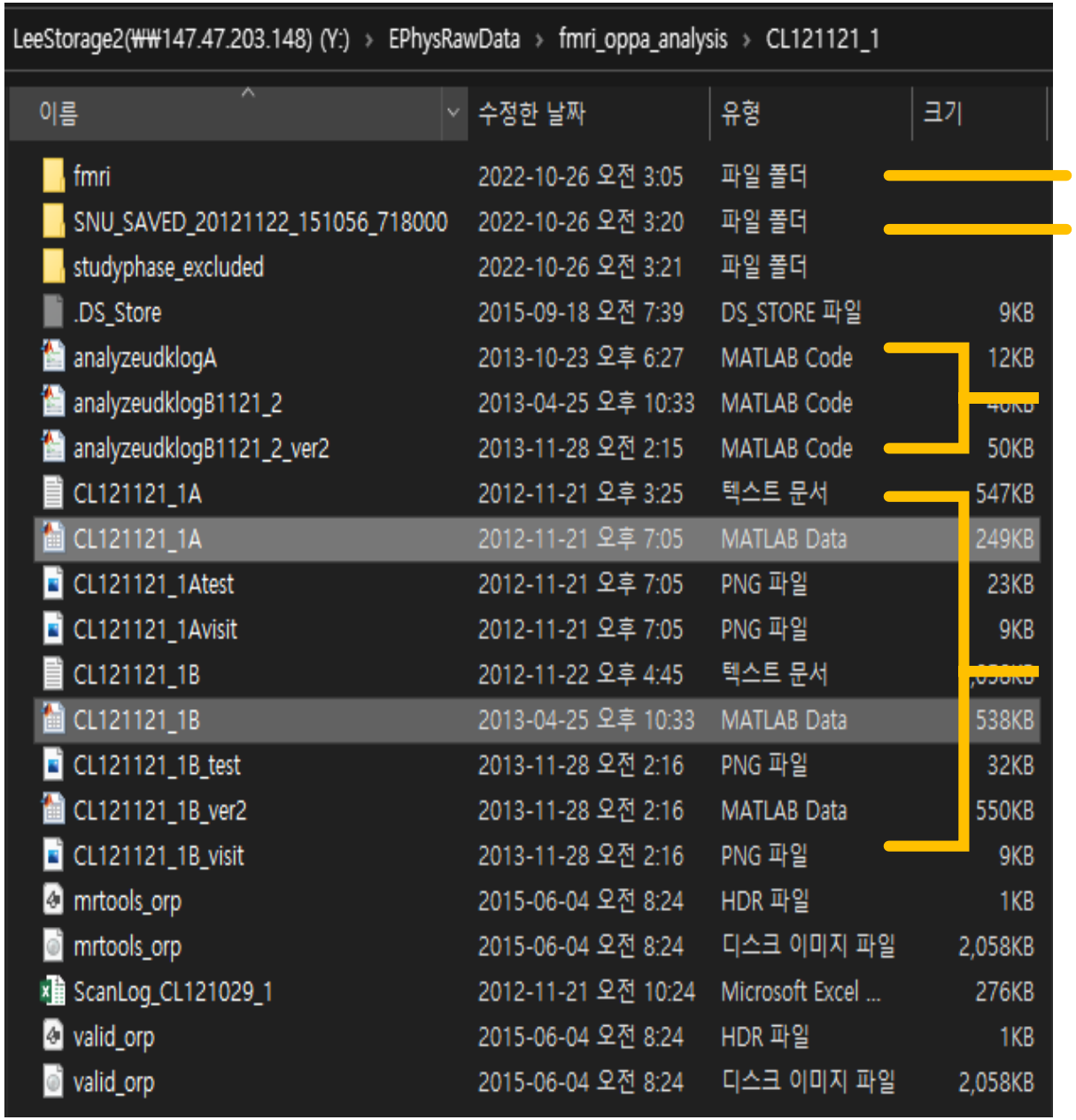
b. Hippocampus segmentation 및 preprocessing 완료됨

Subject summary

총 16명 fMRI data를 사용할 수 있음



Data structure



fMRI pre-processed data

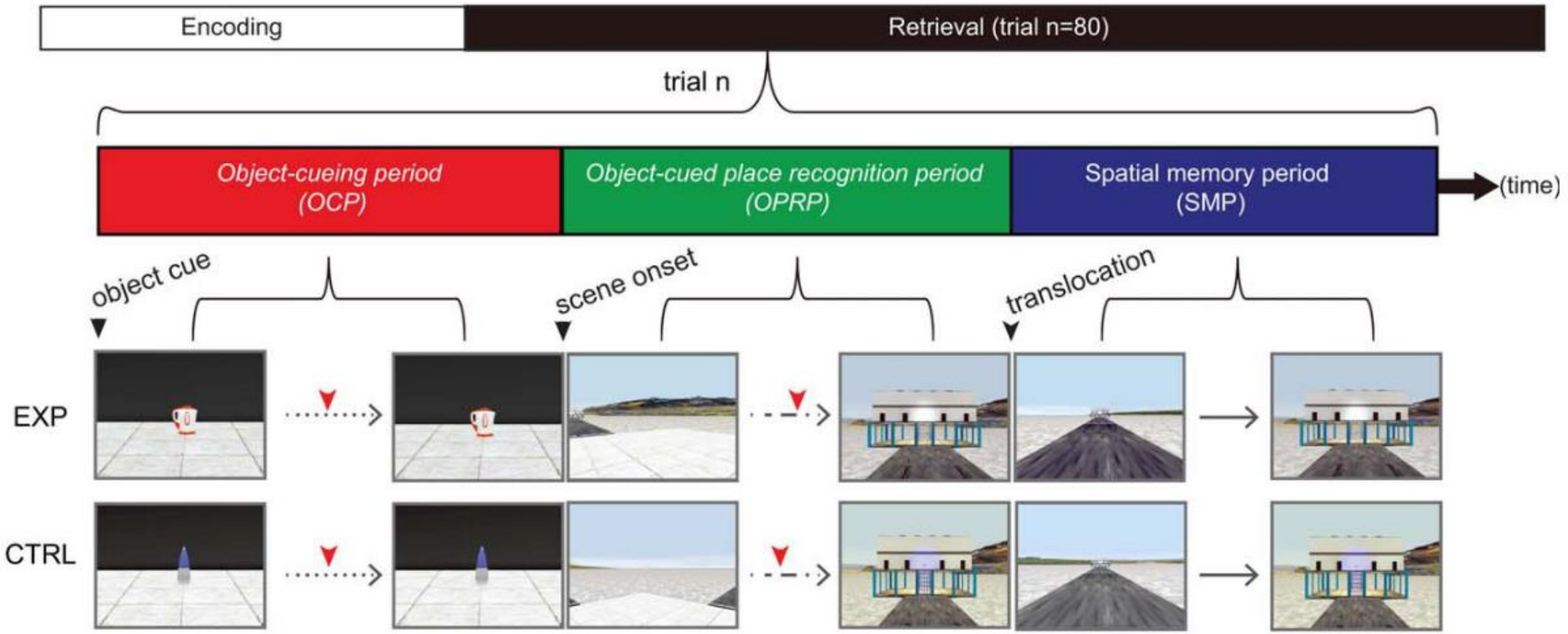
fMRI raw data

UDK log parsing program code

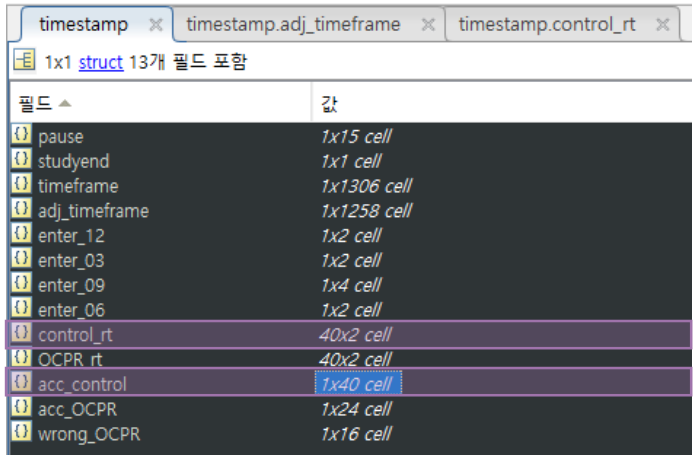
UDK log file
(A=study session, B=test session)

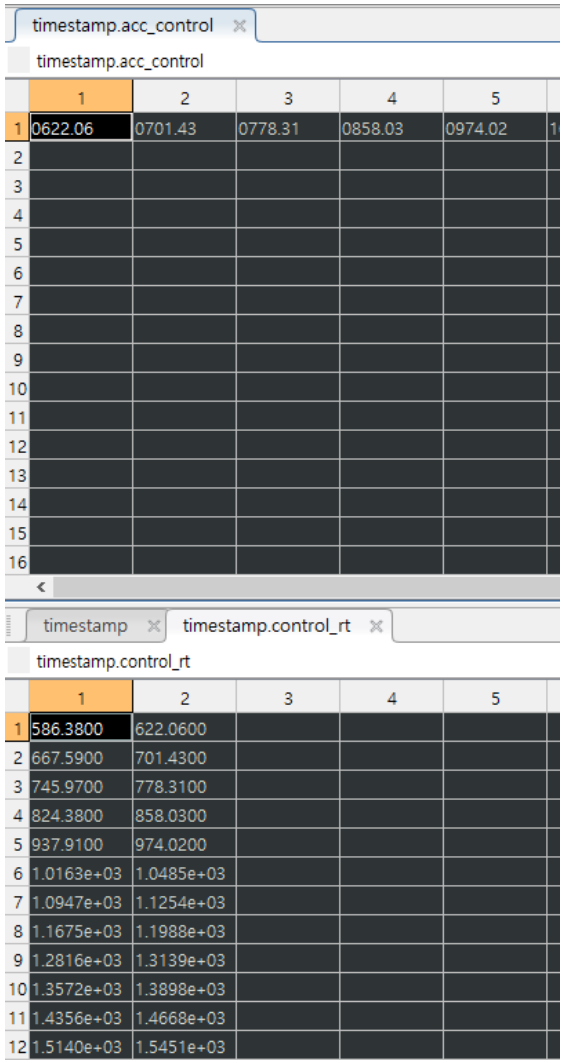
Trial 구조 확인

: CTRL trial + EXP trial



CTRL trials timestamp 확인

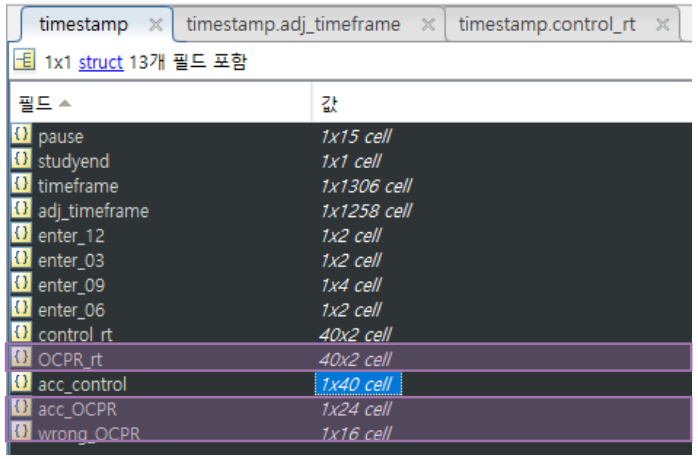


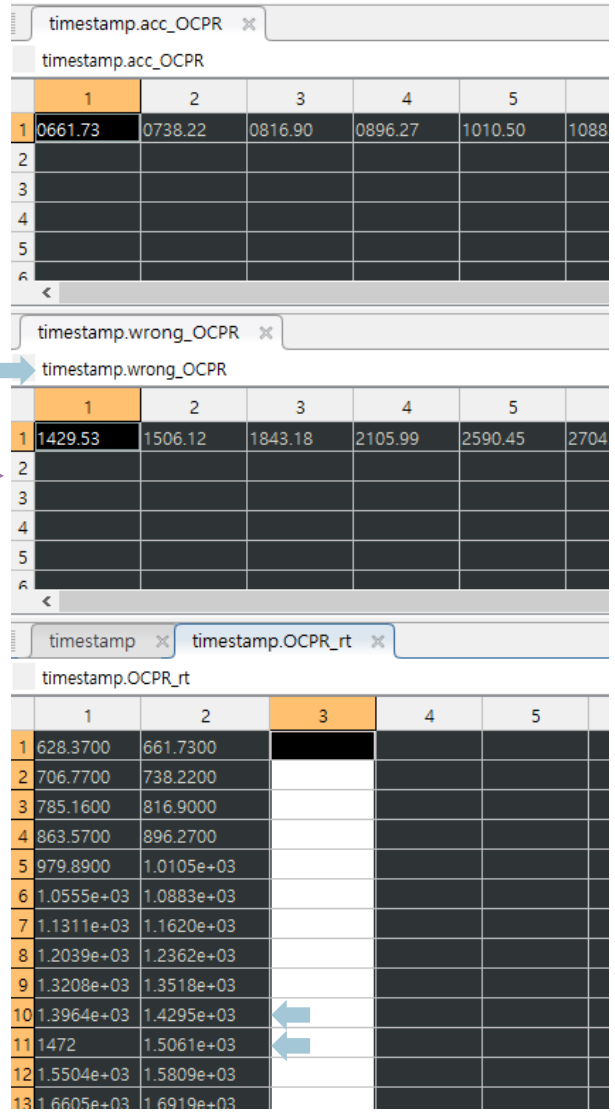


CTRL trials, Correct
Trial end timestamp

CTRL trials, All
Trial start – Trial end

EXP trials timestamp 확인





EXP trials, Correct
Trial end timestamp

EXP trials, Wrong
Trial end timestamp

EXP trials, All
Trial start – Trial end

Encoding phase timestamp 확인

timestamp | timestamp.adj_timeframe | timestamp.control_rt

1x1 struct 13개 필드 포함

필드	값
pause	1x15 cell
studyend	1x1 cell
timeframe	1x1306 cell
adj_timeframe	1x1258 cell
enter_12	1x2 cell
enter_03	1x2 cell
enter_09	1x4 cell
enter_06	1x2 cell
control_rt	40x2 cell
OCPR_rt	40x2 cell
acc_control	1x40 cell
acc_OCPR	1x24 cell
wrong_OCPR	1x16 cell

timestamp.enter_03

	1	2	3	4
1	0188.53	0290.38		
2				
3				
4				
5				

timestamp.enter_06

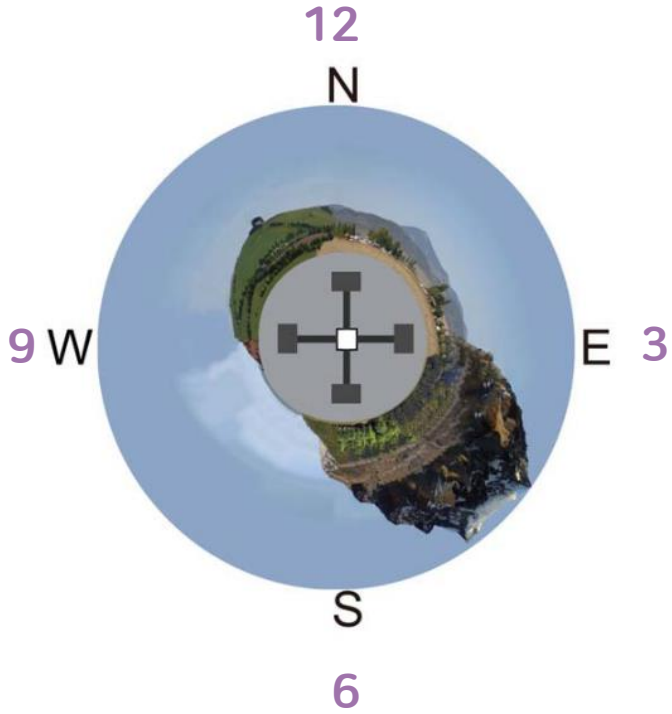
	1	2	3	4
1	0332.53	0432.41		
2				
3				
4				
5				

timestamp.enter_09

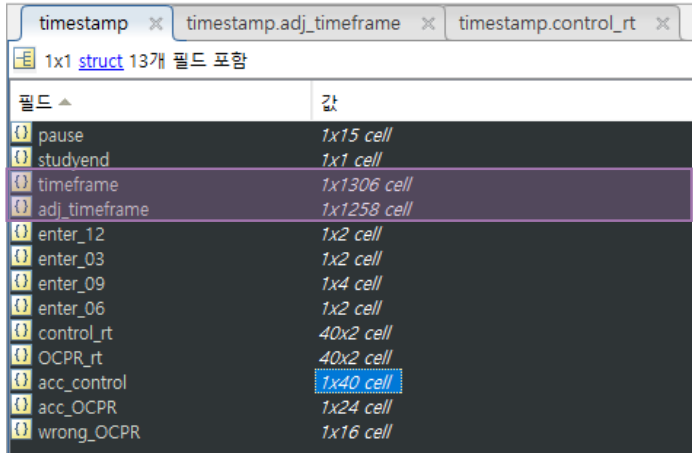
	1	2	3	4
1	0313.29	0329.85	0446.91	0546.43
2				
3				
4				
5				

timestamp.enter_12

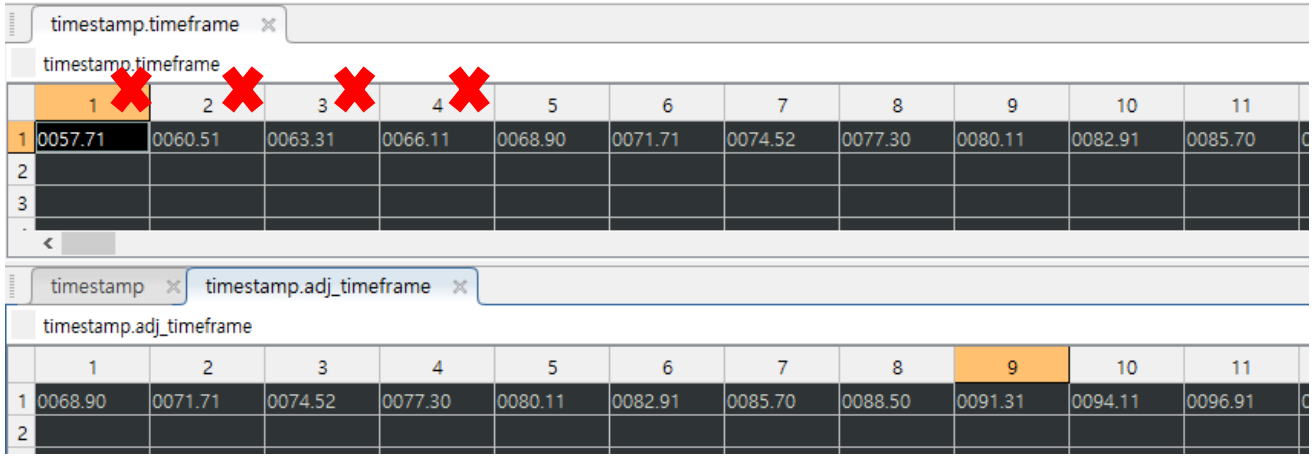
	1	2	3	4
1	0073.99	0175.28		
2				
3				



MR timestamp 확인



fMRI에서 2.8초마다 나오는 신호 + manual input(키보드 5)



Manual input 제거하고 실제 MR image가 있는 timestamp만 모음

Position info : raw data parsing 필요

frame_num | frame_num.epoch3_movement_trace

1x1 struct 10개 필드 포함

필드	값
ocpr	*1306x1 double*
control	*1306x1 double*
ocpr_num	*40x39 double*
control_num	*40x39 double*
rev_control	*1258x1 double*
rev_ocpr	*1258x1 double*
epoch3_movement_trace	*783x4 double*
adj_ocpr_num	*40x39 double*
epoch2_trace	*40x1 double*
adj_control_num	*40x39 double*

frame_num | frame_num.epoch3_movement_trace

frame_num.epoch3_movement_trace

	1	2	3	4	5
166	569.3310	-582.3460	9	1	
167	620.9730	-561.0280	9	1	
168	729.4840	-507.3200	9	1	
169	865.0810	-386.8620	9	1	
170	1.0457e+03	-211.6080	9	1	
171	1.2743e+03	10.4140	9	1	
172	1.5477e+03	275.9450	9	1	
173	1.8856e+03	568.4760	9	1	
174	2.3111e+03	822.9350	9	1	
175	2.8514e+03	966.6250	9	1	
176	3.4727e+03	1.0457e+03	9	1	
177	3.5472e+03	1.0543e+03	9	1	
178	-1147	1080	10	0	
179	-1147	1080	10	0	
180	-1147	1080	10	0	
181	-1147	1080	10	0	
182	-1147	1080	10	0	
183	-1147	1080	10	0	
184	-1147	1080	10	0	
185	-1147	1080	10	0	
186	-1147	1080	10	0	
187	-1.1243e+03	1.0868e+03	10	0	
188	-1.0393e+03	1.1038e+03	10	0	
189	-891.7100	1.1153e+03	10	0	
190	-674.7690	1.1173e+03	10	0	
191	-394.2330	1.0995e+03	10	0	
192	-52.4080	1.0622e+03	10	0	
193	354.9140	1.0477e+03	10	0	
194	833.2680	1.0337e+03	10	0	
195	1.3762e+03	1.0179e+03	10	0	
196	1.9859e+03	1.0001e+03	10	0	
197	2.6266e+03	981.4470	10	0	
198	3.2649e+03	962.8390	10	0	
199	3.5482e+03	948.7950	10	0	
200	565	-584	11	0	
201	565	-584	11	0	
202	565	-584	11	0	

X? Y? EXP Trial? Correctness?

- 각 position 값의 timestamp는?
- 각 timestamp에서 head direction은?
- 각 trial의 correct answer / player choice 정보?

Position info : raw data parsing에 필요한 raw data와 parsing code 모두 있음

- 각 timestamp의 position 및 head direction
- 각 trial의 correct answer / player choice

Raw UDK log

CL130114_2B - Windows 메모장

파일(F) 편집(E) 서식(O) 보기(V) 도움말(H)

```
[1429.49] Cmd: causeevent timeframe
[1429.50] Log: Kismet:  Timeframe
[1429.74] Log: Kismet:  X=-1934.039 Y=1270.085 Z=515.590coordinates
[1429.79] Log: Kismet:  X=0.000 Y=37557.000 Z=0.000rotation
[1430.24] Log: Kismet:  X=-2178.980 Y=1149.021 Z=515.590coordinates
[1430.29] Log: Kismet:  X=0.000 Y=37557.000 Z=0.000rotation
[1430.75] Log: Kismet:  X=-2232.227 Y=1065.528 Z=515.590coordinates
[1430.81] Log: Kismet:  X=0.000 Y=37557.000 Z=0.000rotation
[1431.26] Log: Kismet:  X=-2232.228 Y=1064.244 Z=515.590coordinates
[1431.31] Log: Kismet:  X=0.000 Y=33723.000 Z=0.000rotation
[1431.76] Log: Kismet:  X=-2232.228 Y=1064.244 Z=515.590coordinates
[1431.83] Log: Kismet:  X=0.000 Y=33753.000 Z=0.000rotation
[1431.93] Cmd: causeevent decision
[1431.93] Log: Kismet:  end_control 13
[1431.93] Log: Kismet:  acc_control_correct InterpActor_421 13
[1431.93] Log: Kismet:  correcttrials 7
[1431.93] Log: Kismet:  3rd decision
[1432.28] Log: Kismet:  X=-2232.228 Y=1064.244 Z=515.590coordinates
[1432.29] Cmd: causeevent timeframe
[1432.29] Log: Kismet:  Timeframe
[1432.34] Log: Kismet:  X=0.000 Y=33781.000 Z=0.000rotation
[1432.78] Log: Kismet:  X=-2232.228 Y=1064.244 Z=515.590coordinates
[1432.84] Log: Kismet:  X=0.000 Y=33777.000 Z=0.000rotation
[1432.94] Log: Kismet:  answer 6
[1432.94] Log: Kismet:  choice 6
[1433.28] Log: Kismet:  X=650.000 Y=1081.000 Z=521.008coordinates
[1433.35] Log: Kismet:  X=0.000 Y=65533.000 Z=0.000rotation
[1433.79] Log: Kismet:  X=650.000 Y=1081.000 Z=521.008coordinates
[1433.86] Log: Kismet:  X=0.000 Y=65503.000 Z=0.000rotation
[1433.97] Log: Kismet:  task number: 14
[1434.29] Log: Kismet:  X=650.000 Y=1081.000 Z=521.008coordinates
[1434.36] Log: Kismet:  X=0.000 Y=65473.000 Z=0.000rotation
[1434.80] Log: Kismet:  X=650.000 Y=1081.000 Z=521.008coordinates
[1434.85] Log: Kismet:  X=0.000 Y=65449.000 Z=0.000rotation
[1435.08] Cmd: causeevent timeframe
```

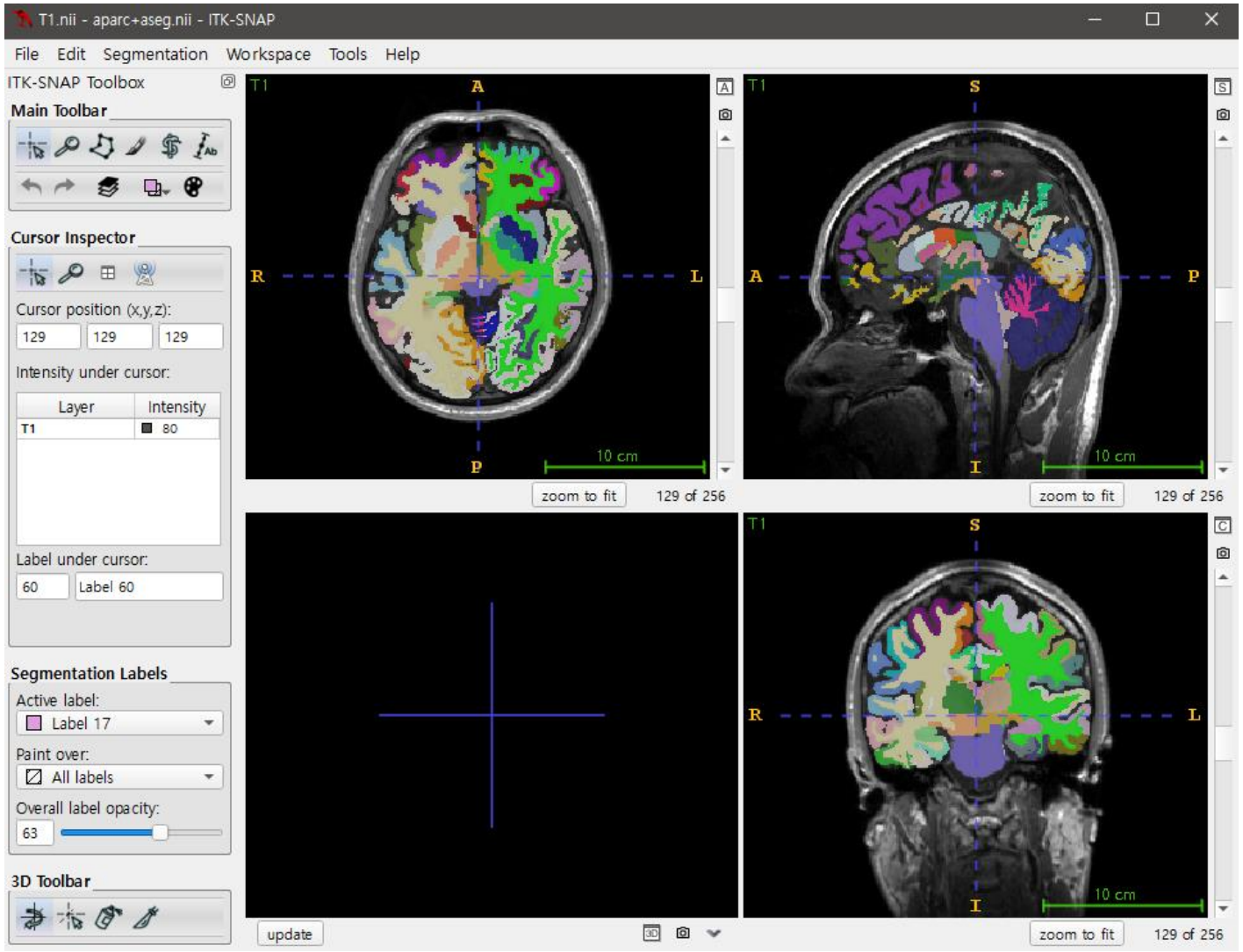
Ln 6641, Col 25 | 100% | Windows (CRLF) | ANSI

Log parsing code

analyzeudklogB0114_2_ver2.m

```
%analyzeudklog.m
close all;clear all;clc
%IMPORTFILE(FILETOREAD1)
%  Imports data from the specified file
%  FILETOREAD1:  file to read

%  Auto-generated by MATLAB on 27-Aug-2012 12:13:16
filename='CL130114_2B';
fileToRead1=strcat(filename,'.log');
DELIMITER = ' ';
HEADERLINES = 22511;
no_trials=80;

% Import the file
rawData1 = importdata(fileToRead1, DELIMITER, HEADERLINES);

% For some simple files (such as a CSV or JPEG files), IMPORTDATA might
% return a simple array.  If so, generate a structure so that the output
% matches that from the Import Wizard.
[~,name] = fileparts(fileToRead1);
log_data=rawData1;

%%Get timestamps
no_lines=max(size(log_data));
count_pause=0;count_timeframe=0; count_12=0; count_03=0; count_06=0; count_09=0;

for i=1:1:no_lines
    k=strfind(log_data{i},'Pause');
    if ~isempty(k)
        count_pause=count_pause+1;
        line_indice_pause(count_pause)=i;
        string=log_data{i};
        timestamp_pause{count_pause}=string(2:8);
```

MR data : SPM 사용한 trial parsing 필요



- Freesurfer 사용한 segmentation 완료
- SPM을 사용한 pre-processing 완료

- Mat file로 MR image가 변환된 것이 없어서,
  pre-processing 완료된 파일을 SPM으로 변환 필요

  (timestamp * voxel 형태)

Analysis plan

~11/09 — **Behavior data** UDK log parsing하여,

timestamp별 position, head direction, trial info 표시된 array 생성

~11/11 — **MR data** SPM processing 진행,

timestamp*voxel 형태의 MR BOLD activity array 생성

~11/15 — **Trial별 hippocampus activity** average,

trial – correctness – reaction time – HPC activity로 구성된 array 생성
correct / wrong trial에 따른 hippocampus activity 분포 확인