EEG Challenge(2025)

*train set : release 1 ~ 10 / val set : release 5 / test set : release 12 (not yet)

Challenge1. Cross-Task Transfer Learning

- Input : SuS(Surround Suppression) task EEG
- Output : CCD(Contrast Change Detection) response time via regression
- Evaluation Equation : nRMSE = RMSE / std(y_true)

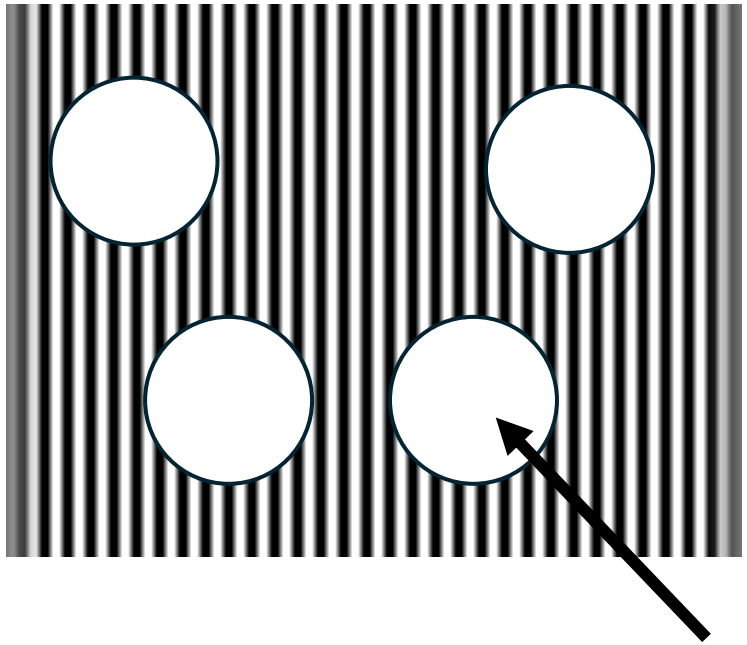
Passive task(SuS) EEG만 보고, Active task(CCD)의 trial 별 반응시간을 예측하는 모델(회귀) 구현

Passive Task – Surround Suppression

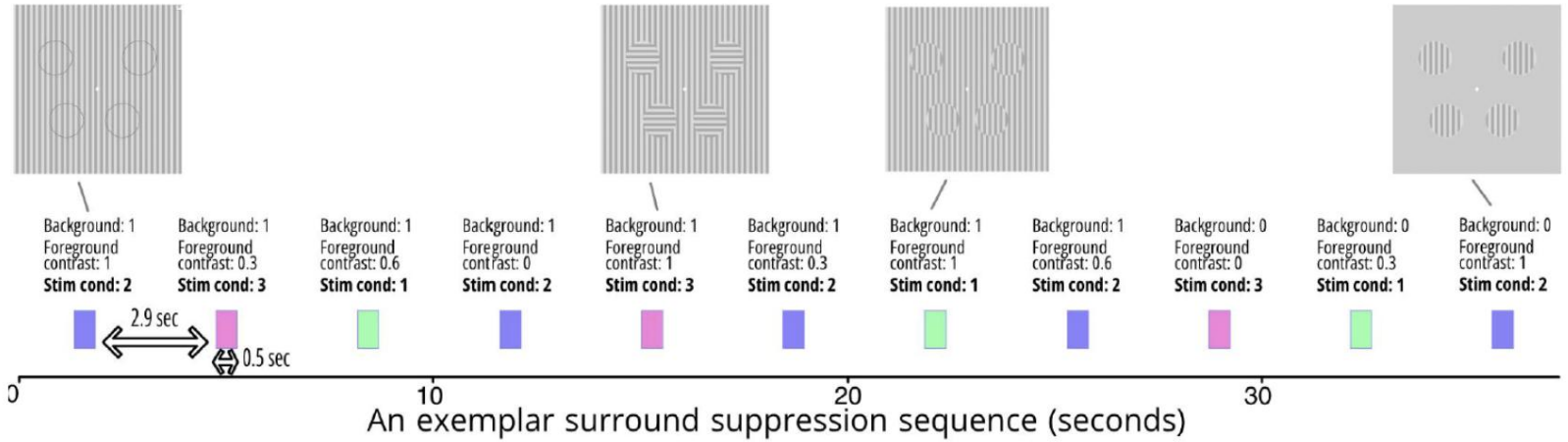
어떤 자극(예: 중심의 시각 패턴)을 지각할 때, 주변 자극이 함께 제시되면 중심 자극에 대한 뇌 반응이 줄어드는 현상을 연구하는 데 활용

https://youtu.be/tOW2Vu2zHoU?si=KGJiL7X7I9rX9zE6

Background : 격자 무늬

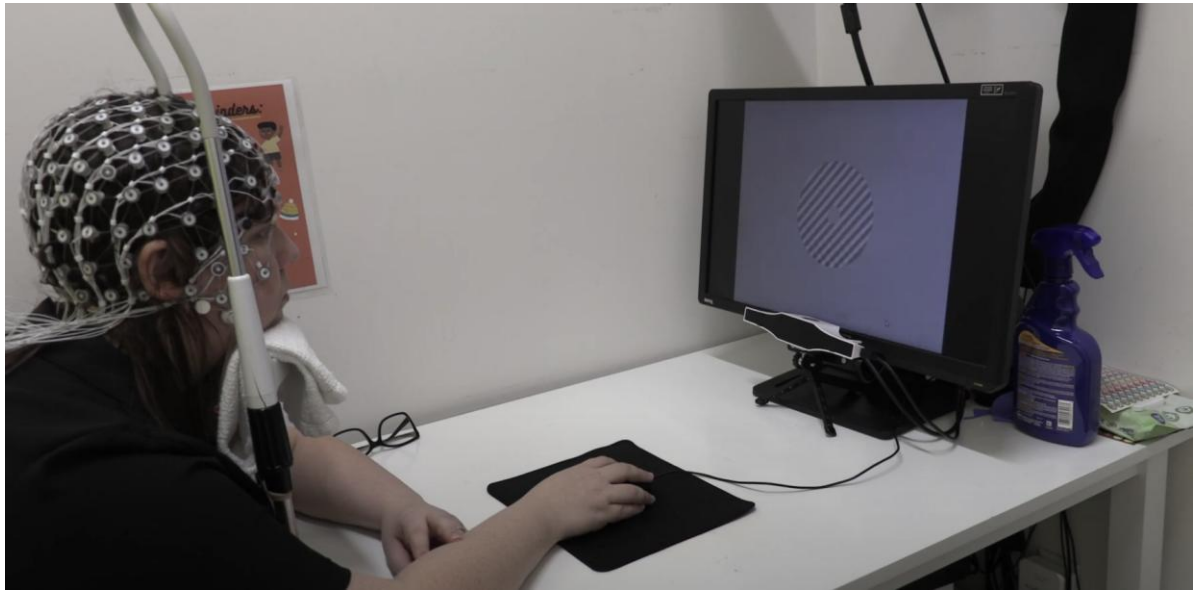


Foreground : 원 내부
*시간에 따라 무늬가 달라짐



- SuS Task는 run 1-2 (2회 수행)
- 총 3.6분 길이의 Task. 한 trial 의 duration이 2.4sec

Active Task – Contrast Change Detection



right button

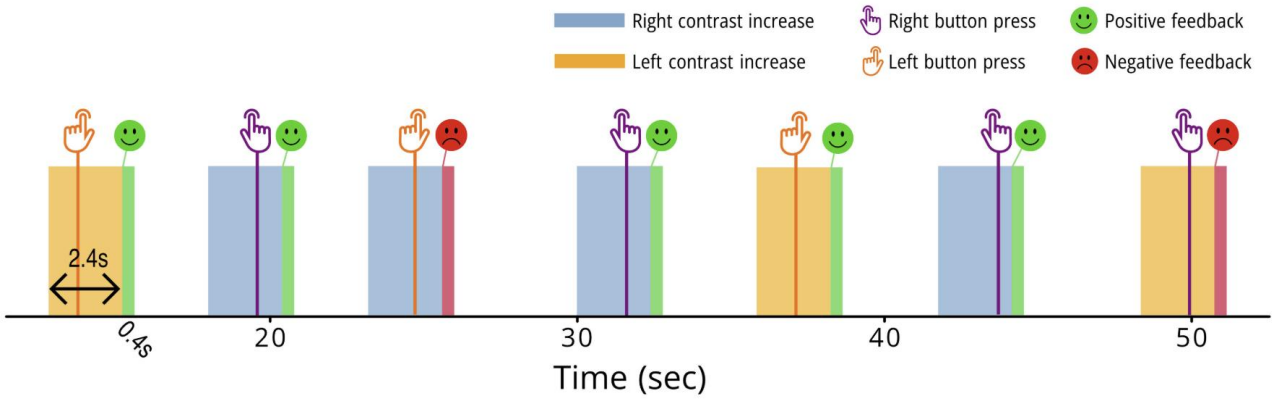
left button

왼쪽으로 기울어진 격자와 오른쪽으로 기울어진 격자가 번갈아 제시됨. 무작위 시간이 지난 후 한 원판의 대비가 변했을 때, 어느쪽 원판의 대비가 더 강한지 빨리 식별하도록 함.

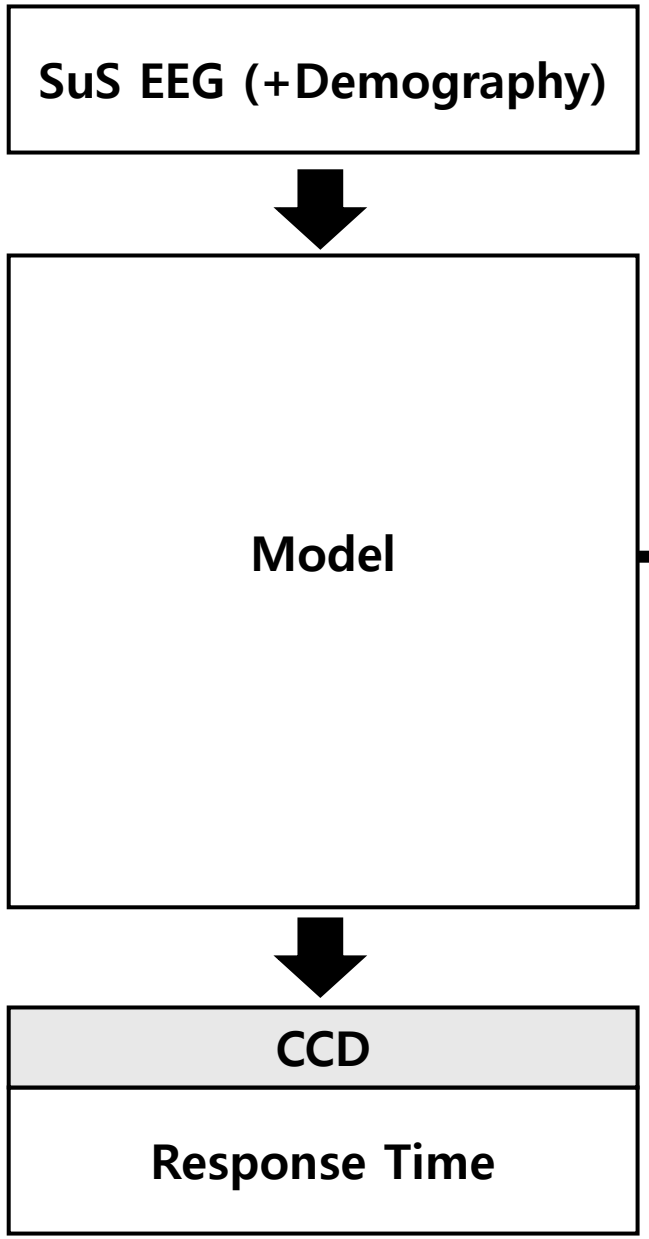
참가자의 반응에 따라,
- 맞으면 스마일 얼굴
- 틀리면 슬픈 얼굴

을 보여줌.

Exemplar Contrast Change Detection (CCD) trial sequence



CCD Task는 한 trial의 duration이 2.4sec. run 1-3 (총 3회 수행)

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EEGNeX (EEGNeX)
├─Sequential (block_1): 1-1
│    └─Rearrange (0): 2-1
│    └─Conv2d (1): 2-2
│    └─BatchNorm2d (2): 2-3
├─Sequential (block_2): 1-2
│    └─Conv2d (0): 2-4
│    └─BatchNorm2d (1): 2-5
├─Sequential (block_3): 1-3
│    └─ParametrizedConv2dWithConstraint (0): 2-6
│    │    └─ModuleDict (parametrizations): 3-1
│    └─BatchNorm2d (1): 2-7
│    └─ELU (2): 2-8
│    └─AvgPool2d (3): 2-9
│    └─Dropout (4): 2-10
├─Sequential (block_4): 1-4
│    └─Conv2d (0): 2-11
│    └─BatchNorm2d (1): 2-12
├─Sequential (block_5): 1-5
│    └─Conv2d (0): 2-13
│    └─BatchNorm2d (1): 2-14
│    └─ELU (2): 2-15
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Baseline

braindecode 라이브러리의 모델

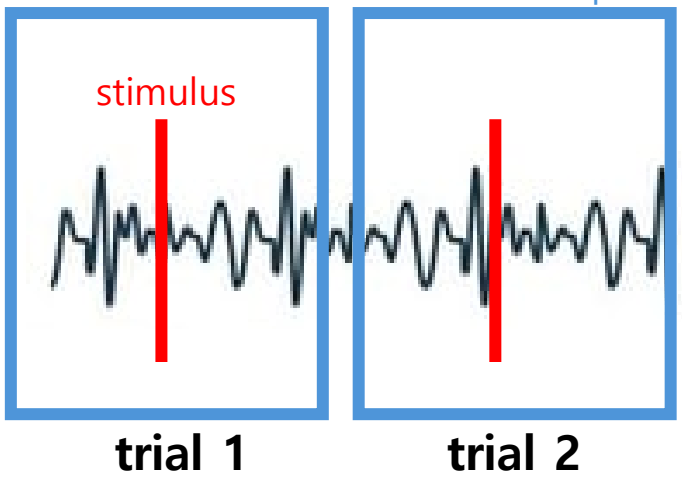
Question

모델 학습을 위한 데이터셋을 X = SuS EEG, y = CCD Response Time 으로 구성해야 함.
이때 X, y 매칭을 어떻게? Subject ID 기준으로?

Subject 1

SuS EEG

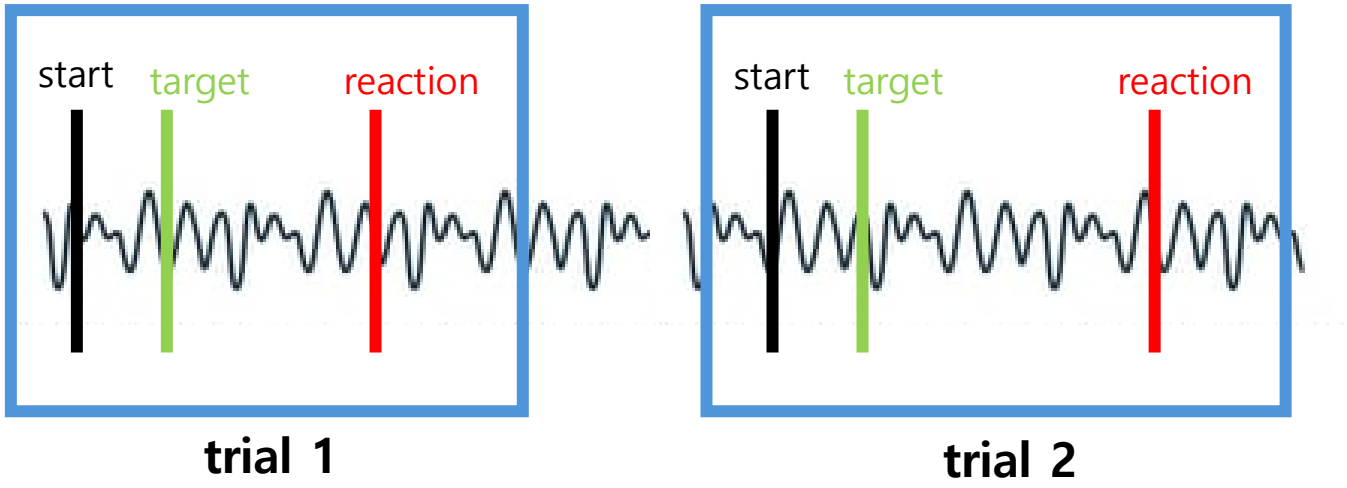
epoching



onset	duration	sample	value	event_code	background	foreground_contrast	stimulus_cond
0	n/a	0	break cnt	break cnt	n/a	n/a	n/a
37.018	n/a	18509	surroundSuppB1_start	93	n/a	n/a	n/a
38.566	n/a	19283	fixpoint_ON	4	n/a	n/a	n/a
39.084	2.4	19542	stim_ON	8	1	0	2
41.992	n/a	20996	fixpoint_ON	4	n/a	n/a	n/a
42.502	2.4	21251	stim_ON	8	1	0.3	3
45.412	n/a	22706	fixpoint_ON	4	n/a	n/a	n/a
45.922	2.4	22961	stim_ON	8	1	0.6	1
48.832	n/a	24416	fixpoint_ON	4	n/a	n/a	n/a
49.342	2.4	24671	stim_ON	8	1	1	2
52.252	n/a	26126	fixpoint_ON	4	n/a	n/a	n/a
52.762	2.4	26381	stim_ON	8	1	0	3
55.672	n/a	27836	fixpoint_ON	4	n/a	n/a	n/a
56.182	2.4	28091	stim_ON	8	1	0.3	2

CCD EEG

epoching



onset	duration	sample	value	event_code	feedback
0	n/a	0	break cnt	break cnt	n/a
33.4	n/a	16700	contrastChangeB1_start	94	n/a
39.484	n/a	19742	contrastTrial_start	5	n/a
42.284	n/a	21142	right_target	9	n/a
44.414	n/a	22207	right_buttonPress	13	smiley_face
44.684	n/a	22342	contrastTrial_start	5	n/a
47.484	n/a	23742	right_target	9	n/a
49.444	n/a	24722	right_buttonPress	13	smiley_face
49.884	n/a	24942	contrastTrial_start	5	n/a
54.284	n/a	27142	right_target	9	n/a
56.304	n/a	28152	right_buttonPress	13	smiley_face
56.684	n/a	28342	contrastTrial_start	5	n/a
62.684	n/a	31342	right_target	9	n/a