

# Proposal\_Fateme\_Nikseresht

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## 1 A Decision Tool for Emotion Dysregulation Intervention

- Project proposal for University of Virginia SYS 6014 Decision Analysis Spring 2020

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### 1.1 Introduction

Nowadays, self-tracking technologies are commonly used in areas like fitness and personal health. In this project, I am going to use self-tracking to enhance user's emotions. People do have an interest in utilizing technology to improve their emotions in different situations. I, however, advocate for a stronger focus on users to self-track their emotions at work, home, party and etc. For this purpose, users' physical signals which are collected in real-time with the smart band are used. As there are plenty of existing researches in emotion recognition using physical signals, I assumed that the user's emotion elicited from their physiological signals. Therefore, my main focus will be on designing a decision-making system to enhance the user's emotion. To achieve this, my decision tool system will send feedback to the user, considering her profile, preferences, and environment. In other words, the decision making tool decides which approach works effectively for a specific type of emotion and a certain user.

### 1.2 Data Set

I simulated a data set contains 60 participants. The simulated data-set reflects participant's age group, gender, four various emotion types with two different stages(Extremely Bored, Bored, Extremely Amused, Amused, Extremely relaxed, Relaxed, Extremely Scared, Scared). I am going to possibly use it to drive behavioral changes.

### 1.3 Problem Framework

- **Action Set (Decision):**

$A: \{a_1, a_2, \dots, a_n\}$   $a_1 = \text{FeedBack Type 1}, a_2 = \text{FeedBack Type 2}, \dots, a_n = \text{FeedBack Type N}$   
 $A_t = \text{Argmin}(X_{t+1} - X^d)^2$

- **Current Emotion Type:**

$X: \{x_1, \dots, x_8\}$   
 $X_m = \text{Argmax}(p(x_m))$

- **State Space (Detcted Emotion Type):**

$\hat{X}: \{\hat{x}_1, \dots, \hat{x}_8\}$   $\hat{x}_1 = \text{Emotion type(Extremely Bored)}, \hat{x}_2 = \text{Emotion type 2(Extremely Amused)},$

$\hat{x}_3 = \text{Emotion type 3(Extremely relaxed)}, \hat{x}_4 = \text{Emotion type 4(Extremely Scared)}, \hat{x}_5 = \text{Emotion type 5(Bored)}, \hat{x}_6 = \text{Emotion type 6(Amused)}, \hat{x}_7 = \text{Emotion type 7(Relaxed)}, \hat{x}_8 = \text{Emotion type 8(Scared)}$   
 $\hat{X}_m \approx X_m$   
 $X_t = g(X_{t-1}, A_{t-1})$

- **Parameter Space (Probabilithy of Emotion Type):**

$: \{p(x_1), p(x_2), \dots, p(x_8)\}$   
 $P(x_m) = h(s_z, f_q)$

- **Physiological Signals:**

$S: \{s_1, \dots, s_i\} s_1 = \text{Signal type 1(EDA)}, \dots, s_i = \text{Signal type I}$

- **Users' Profile (User's age group and gender):**

$F: \{f_1, \dots, f_{60}\} f_1 = \text{First user's profile}, f_2 = \text{Second user's profile}, \dots, f_{60} = \text{60th user's profile}$

- **Users' Circumstances (User's current environment):**

$C: \{c_1, \dots, c_j\} c_1 = \text{Environment type 1}, \dots, c_{60} = \text{Environment type J}$

- **Users' Prefrences (User's feedback preference):**

$R: \{r_1, \dots, r_{60}\} r_1 = \text{1st user's preference}, \dots, r_{60} = \text{60th user's preference}$

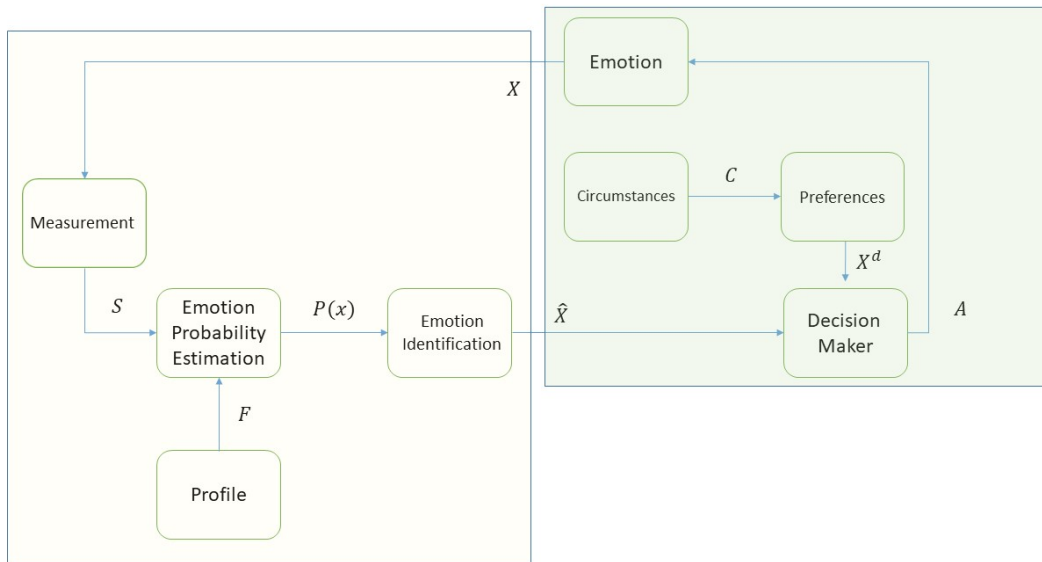
- **Desired Emotion:**

$X^d$

- **Loss Function:**

$L = \min \sum_t (X_{t+1} - X^d)^2$

## 1.4 System Diagram



## 2 Script

### 2.0.1 Data Simulation

#### Importing required libraries

```
[6]: import pandas as pd
import os, sys
import random
```

Read a profile CSV file which contains participants' ID numbers, genders, and age group .

```
[7]: data = pd.read_csv('D:/Dropbox/Bias Data/Simulation.csv')
data = data.set_index('Participant-ID')
#data
```

Create a data frame which contains eight different emotion status (four emotion type with two stage) for each participant. Each participant will experience all of this emotion status but in a random sequence.

```
[8]: status = ["bored-1", "amused-1", "relaxed-1", "scared-1", "bored-2", "amused-2",
    ↳ "relaxed-2", "scared-2"]
emotion = pd.DataFrame()
for x in range(60):
    emotion = pd.concat([emotion, pd.DataFrame(status).transpose()], axis=0)
    random.shuffle(status)

emotion = emotion.rename(columns={0: 'Status1', 1: 'Status2', 2: 'Status3', 3:
    ↳ 'Status4', 4: 'Status5', 5: 'Status6', 6: 'Status7', 7: 'Status8'})
o = pd.Series(range(1,61))
emotion.index=o
#emotion
```

Concatenate profile dataframe with emotion status dataframe.

```
[10]: df= pd.concat([data, emotion], axis=1 )
df
```

```
[10]:
```

	Sex	Age-Group	Status1	Status2	Status3	Status4	Status5	\
1	F	30-34	bored-1	amused-1	relaxed-1	scared-1	bored-2	
2	F	25-29	bored-2	amused-2	relaxed-2	scared-2	amused-1	
3	F	30-34	amused-2	amused-1	scared-2	scared-1	relaxed-2	
4	F	20-24	amused-2	scared-2	amused-1	scared-1	bored-1	
5	M	20-24	bored-2	scared-2	relaxed-2	relaxed-1	amused-2	
6	M	30-34	scared-1	relaxed-1	relaxed-2	bored-1	amused-1	
7	M	25-29	relaxed-2	amused-2	scared-2	amused-1	bored-2	
8	F	25-29	bored-2	amused-1	relaxed-1	scared-2	bored-1	
9	F	20-24	scared-1	scared-2	bored-2	amused-2	relaxed-1	
10	M	35-39	bored-1	amused-2	relaxed-1	scared-2	amused-1	

11	M	25-29	bored-1	amused-2	relaxed-2	bored-2	scared-1
12	M	25-29	bored-2	amused-1	relaxed-1	scared-2	amused-2
13	F	25-29	relaxed-1	bored-1	relaxed-2	bored-2	amused-1
14	M	20-24	amused-2	relaxed-1	bored-2	relaxed-2	scared-1
15	F	20-24	scared-1	scared-2	amused-2	relaxed-2	bored-1
16	F	20-24	relaxed-1	bored-1	scared-2	bored-2	amused-2
17	F	20-24	bored-1	scared-2	amused-1	relaxed-1	bored-2
18	M	25-29	amused-1	scared-1	bored-2	bored-1	relaxed-1
19	F	20-24	amused-1	relaxed-1	bored-2	relaxed-2	amused-2
20	M	35-39	scared-2	amused-2	scared-1	bored-2	relaxed-2
21	M	20-24	relaxed-2	scared-1	amused-1	bored-2	bored-1
22	F	20-24	amused-2	relaxed-1	scared-1	relaxed-2	bored-2
23	M	25-29	amused-1	bored-2	scared-1	amused-2	bored-1
24	F	25-29	amused-2	amused-1	bored-2	relaxed-2	relaxed-1
25	F	25-29	relaxed-1	bored-1	relaxed-2	amused-2	bored-2
26	M	25-29	scared-1	amused-2	relaxed-2	scared-2	amused-1
27	M	25-29	bored-1	bored-2	scared-1	scared-2	relaxed-2
28	M	25-29	relaxed-2	amused-1	bored-1	relaxed-1	bored-2
29	M	25-29	relaxed-2	relaxed-1	amused-2	amused-1	bored-2
30	F	25-29	scared-2	amused-1	bored-2	relaxed-1	relaxed-2
31	F	30-34	bored-1	amused-1	scared-1	scared-2	relaxed-1
32	F	15-19	bored-1	scared-2	relaxed-1	bored-2	relaxed-2
33	F	20-24	amused-1	relaxed-1	bored-1	amused-2	relaxed-2
34	F	15-19	scared-1	amused-2	bored-1	bored-2	amused-1
35	M	30-34	relaxed-2	relaxed-1	amused-2	bored-2	scared-1
36	M	35-39	relaxed-2	amused-2	scared-2	bored-2	amused-1
37	M	15-19	relaxed-1	bored-2	amused-2	scared-2	scared-1
38	F	15-19	relaxed-1	scared-1	scared-2	amused-2	amused-1
39	F	35-39	scared-1	amused-1	relaxed-2	scared-2	relaxed-1
40	M	20-24	scared-2	relaxed-2	scared-1	amused-1	bored-2
41	M	15-19	scared-2	scared-1	bored-2	relaxed-1	amused-1
42	M	35-39	scared-1	bored-1	amused-2	relaxed-2	bored-2
43	F	20-24	scared-2	relaxed-1	bored-1	scared-1	amused-1
44	M	20-24	bored-2	amused-2	scared-2	bored-1	amused-1
45	F	35-39	relaxed-1	relaxed-2	scared-2	scared-1	amused-2
46	F	30-34	scared-2	relaxed-2	relaxed-1	bored-2	amused-1
47	F	15-19	amused-2	relaxed-2	bored-2	amused-1	bored-1
48	M	15-19	amused-1	amused-2	relaxed-1	bored-1	bored-2
49	F	35-39	relaxed-1	bored-1	amused-1	bored-2	relaxed-2
50	M	35-39	scared-2	relaxed-1	scared-1	bored-1	amused-2
51	M	30-34	relaxed-2	relaxed-1	amused-1	scared-2	bored-1
52	F	20-24	relaxed-2	amused-2	bored-1	scared-1	relaxed-1
53	M	15-19	scared-2	bored-2	scared-1	bored-1	relaxed-2
54	F	30-34	relaxed-2	scared-2	bored-2	relaxed-1	amused-2
55	F	15-19	relaxed-1	scared-1	relaxed-2	amused-2	amused-1
56	M	20-24	scared-2	relaxed-1	bored-2	scared-1	amused-1
57	M	30-34	bored-2	amused-1	bored-1	scared-2	relaxed-2

58	M	20-24	relaxed-2	scared-1	relaxed-1	scared-2	amused-2
59	M	15-19	amused-1	relaxed-1	scared-1	amused-2	relaxed-2
60	F	15-19	scared-2	amused-2	amused-1	relaxed-1	bored-1

	Status6	Status7	Status8
1	amused-2	relaxed-2	scared-2
2	bored-1	scared-1	relaxed-1
3	bored-2	relaxed-1	bored-1
4	relaxed-2	bored-2	relaxed-1
5	bored-1	scared-1	amused-1
6	amused-2	bored-2	scared-2
7	bored-1	relaxed-1	scared-1
8	relaxed-2	scared-1	amused-2
9	amused-1	relaxed-2	bored-1
10	bored-2	scared-1	relaxed-2
11	relaxed-1	scared-2	amused-1
12	scared-1	bored-1	relaxed-2
13	scared-2	amused-2	scared-1
14	bored-1	scared-2	amused-1
15	amused-1	relaxed-1	bored-2
16	relaxed-2	scared-1	amused-1
17	relaxed-2	scared-1	amused-2
18	relaxed-2	amused-2	scared-2
19	scared-2	bored-1	scared-1
20	bored-1	amused-1	relaxed-1
21	amused-2	relaxed-1	scared-2
22	scared-2	bored-1	amused-1
23	scared-2	relaxed-1	relaxed-2
24	scared-1	bored-1	scared-2
25	amused-1	scared-2	scared-1
26	bored-1	bored-2	relaxed-1
27	amused-1	amused-2	relaxed-1
28	scared-2	scared-1	amused-2
29	scared-1	bored-1	scared-2
30	bored-1	scared-1	amused-2
31	amused-2	bored-2	relaxed-2
32	amused-1	amused-2	scared-1
33	scared-2	bored-2	scared-1
34	scared-2	relaxed-2	relaxed-1
35	scared-2	bored-1	amused-1
36	relaxed-1	scared-1	bored-1
37	amused-1	relaxed-2	bored-1
38	bored-2	relaxed-2	bored-1
39	bored-1	amused-2	bored-2
40	bored-1	relaxed-1	amused-2
41	relaxed-2	amused-2	bored-1
42	scared-2	relaxed-1	amused-1

43	relaxed-2	bored-2	amused-2
44	relaxed-1	scared-1	relaxed-2
45	bored-1	bored-2	amused-1
46	bored-1	scared-1	amused-2
47	scared-2	relaxed-1	scared-1
48	relaxed-2	scared-2	scared-1
49	amused-2	scared-1	scared-2
50	amused-1	relaxed-2	bored-2
51	bored-2	amused-2	scared-1
52	bored-2	amused-1	scared-2
53	relaxed-1	amused-2	amused-1
54	amused-1	bored-1	scared-1
55	bored-1	bored-2	scared-2
56	amused-2	bored-1	relaxed-2
57	relaxed-1	scared-1	amused-2
58	bored-2	amused-1	bored-1
59	bored-1	bored-2	scared-2
60	bored-2	scared-1	relaxed-2