SVKM's NMIMS

Mukesh Patel School of Technology Management & Engineering Computer Engineering Department Program: B. Tech/MBA Tech EXTC

Course: B. Tech/MBA. Tech (EXTC)

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Batch: C1	Date of Experiment: 11-02-2022
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AIM: -To implement descriptive models of stimulus cognition using statistical tests and supervise machine learning algorithms

Instructions and Objective:

- 1. Download FTheta and OTheta from file section team
- 2. Curate the data if required
- 3. Perform various statistical analysis to create region descriptive and asymmetry descriptive model (for both dataset)
- 4. Perform t-test and one-way ANOVA (analysis of variance)

Google Colab Links:

F-Theta

https://colab.research.google.com/drive/11YXwuMgolldhz1iyVFACmRBOz66j-jhU?usp=sharing

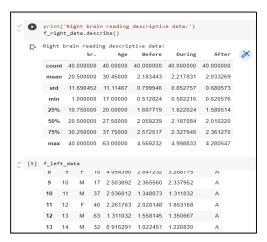
O-Theta

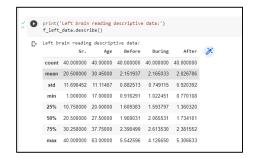
https://colab.research.google.com/drive/1Sks57wKaDoE7G80dyd5WHUTOttuQTQfG?usp=sharing

Outcomes:

Otheta

Description of features of right and left brain





Parametric T-test

Appreciator Right: [Alpha-0.05]

Before stimulus & During stimulus Right side data: Statistics=-0.140, p=0.889 Same distribution (fail to reject HO) Before stimulus & After stimulus Right side data: Statistics=1.848, p=0.075 Same distribution (fail to reject H0)

During stimulus & After stimulus Right side data: Statistics=-1.891, p=0.069 Same distribution (fail to reject H0)

Appreciator Left: [Alpha-0.05]

Before stimulus & During stimulus Left side data: Statistics=0.121, p=0.905 Same distribution (fail to reject H0)

Before stimulus & After stimulus Left side data: Statistics=1.749, p=0.091 Same distribution (fail to reject H0)

During stimulus & After stimulus Left side data: Statistics=1.186, p=0.245 Same distribution (fail to reject H0)

Non-Appreciator Right: [Alpha-0.05]

Before stimulus & During stimulus Right side data: Statistics=-0.607, p=0.557 Same distribution (fail to reject H0) Before stimulus & After stimulus Right side data: Statistics=-0.071, p=0.945 Same distribution (fail to reject H0)

During stimulus & After stimulus Right side data: Statistics=-0.491, p=0.634 Same distribution (fail to reject H0)

Non-Appreciator Left: [Alpha-0.05]

Before stimulus & During stimulus Left side data: Statistics=-1.048, p=0.319 Same distribution (fail to reject H0) Before stimulus & After stimulus Left side data: Statistics=-0.054, p=0.958 Same distribution (fail to reject H0)

During stimulus & After stimulus Left side data: Statistics=0.790, p=0.448 Same distribution (fail to reject H0)

Annova

Right Appreciator

Statistics=0.792, p=0.456

Left Appreciator

C→ Statistics=0.360, p=0.699

Right Non - Appreciator

Statistics=0.024, p=0.977

<u>Left Non – Appreciator</u>

Statistics=0.038, p=0.963

Non – Parametric [Wilcoxon Test]

Appreciator right

Before stimulus & During stimulus Right side data:
Statistics=210.000, p=0.871
Same distribution (fail to reject H0)

Before stimulus & After stimulus Right side data:
Statistics=136.000, p=0.078
Same distribution (fail to reject H0)

After stimulus & During stimulus Right side data:
Statistics=131.000, p=0.061
Same distribution (fail to reject H0)

Appreciator left

```
Before stimulus & During stimulus Left side data:
Statistics=194.000, p=0.611
Same distribution (fail to reject H0)

Before stimulus & After stimulus Left side data:
Statistics=134.000, p=0.071
Same distribution (fail to reject H0)

After stimulus & During stimulus Left side data:
Statistics=156.000, p=0.184
Same distribution (fail to reject H0)
```

Non - Appreciator right

```
Before stimulus & During stimulus Right side data:
Statistics=26.000, p=0.534
Same distribution (fail to reject H0)

Before stimulus & After stimulus Right side data:
Statistics=26.000, p=0.534
Same distribution (fail to reject H0)

After stimulus & During stimulus Right side data:
Statistics=33.000, p=1.000
Same distribution (fail to reject H0)
```

Non - Appreciator left

```
Before stimulus & During stimulus Left side data:
Statistics=21.000, p=0.286
Same distribution (fail to reject H0)

Before stimulus & After stimulus Left side data:
Statistics=33.000, p=1.000
Same distribution (fail to reject H0)

After stimulus & During stimulus Left side data:
Statistics=31.000, p=0.859
Same distribution (fail to reject H0)
```

Man-Whitney Test

Appreciator Right

```
Before stimulus & During stimulus Right side data:
Statistics=419.500, p=0.497
Same distribution (fail to reject H0)

Before stimulus & After stimulus Right side data:
Statistics=357.000, p=0.164
Same distribution (fail to reject H0)

After stimulus & During stimulus Right side data:
Statistics=365.000, p=0.196
Same distribution (fail to reject H0)
```

Appreciator Left

```
Before stimulus & During stimulus Left side data:
Statistics=398.000, p=0.366
Same distribution (fail to reject H0)

Before stimulus & After stimulus Left side data:
Statistics=339.000, p=0.104
Same distribution (fail to reject H0)

After stimulus & During stimulus Left side data:
Statistics=326.000, p=0.072
Same distribution (fail to reject H0)
```

Non-Appreciator Right

```
Before stimulus & During stimulus Right side data:
Statistics=58.000, p=0.448
Same distribution (fail to reject H0)

Before stimulus & After stimulus Right side data:
Statistics=59.000, p=0.474
Same distribution (fail to reject H0)

After stimulus & During stimulus Right side data:
Statistics=59.000, p=0.474
Same distribution (fail to reject H0)
```

Non-Appreciator Left

Before stimulus & During stimulus Left side data: Statistics=58.000, p=0.448
Same distribution (fail to reject H0)

Before stimulus & After stimulus Left side data: Statistics=58.000, p=0.448
Same distribution (fail to reject H0)

After stimulus & During stimulus Left side data: Statistics=59.000, p=0.474
Same distribution (fail to reject H0)

Asymmetric

T-test Appreciator

Before stimulus & During stimulus: Statistics=-0.024, p=0.981 Same distribution (fail to reject H0)

After stimulus & Before stimulus: Statistics=2.222, p=0.035 Different distribution (reject H0)

After stimulus & During stimulus: Statistics=1.835, p=0.077 Same distribution (fail to reject H0)

T-test Non-Appreciator

Before stimulus & During stimulus: Statistics=-0.970, p=0.355 Same distribution (fail to reject H0)

After stimulus & Before stimulus: Statistics=-0.074, p=0.942 Same distribution (fail to reject H0)

After stimulus & During stimulus: Statistics=0.671, p=0.518 Same distribution (fail to reject H0)

Annova for 'A' and 'N'

```
[39] l = total_data.loc[total_data['Rating']=='A']['Before']
    m = total_data.loc[total_data['Rating']=='A']['During']
    n = total_data.loc[total_data['Rating']=='A']['After']

    F, p = scst.f_oneway(l,m,n)
    print('Statistics=%.3f, p=%.3f' % (F, p))

    Statistics=0.748, p=0.477

    1 = total_data.loc[total_data['Rating']=='N']['Before']
    m = total_data.loc[total_data['Rating']=='N']['During']
    n = total_data.loc[total_data['Rating']=='N']['After']

    F, p = scst.f_oneway(l,m,n)
    print('Statistics=%.3f, p=%.3f' % (F, p))

    Statistics=0.033, p=0.967
```

Non Parametric Wilcoxon

Appreciator

```
Before stimulus & During stimulus Right side data:
Statistics=210.000, p=0.871
Same distribution (fail to reject H0)

Before stimulus & After stimulus Right side data:
Statistics=118.000, p=0.031
Different distribution (reject H0)

After stimulus & During stimulus Right side data:
Statistics=148.000, p=0.133
Same distribution (fail to reject H0)
```

Non-Appreciator

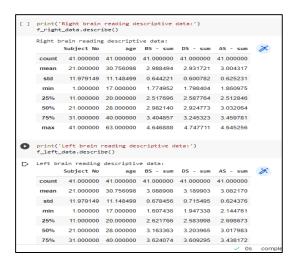
```
Before stimulus & During stimulus Right side data:
Statistics=20.000, p=0.248
Same distribution (fail to reject H0)

Before stimulus & After stimulus Right side data:
Statistics=31.000, p=0.859
Same distribution (fail to reject H0)

After stimulus & During stimulus Right side data:
Statistics=33.000, p=1.000
Same distribution (fail to reject H0)
```

F-Theta

Right and Left Brain F-theta



Hypothesis

Hypotheses for paired t-test

 $H00 --> \mu b = \mu d$

 $H01 --> \mu b = \mu a$

 $H02 --> \mu d = \mu a$

H10 --> $\mu b = /= \mu d$

H11 --> $\mu b = /= \mu a$

H12 --> $\mu d = /= \mu a$

Assume the threshold value for p to be 0.05:

Parametric T- test Appreciator right

Before stimulus & During stimulus Right side data: Statistics=1.998, p=0.056 Same distribution (fail to reject H0)

Before stimulus & After stimulus Right side data: Statistics=0.667, p=0.510 Same distribution (fail to reject H0)

During stimulus & After stimulus Right side data: Statistics=0.902, p=0.375 Same distribution (fail to reject H0)

Parametric T- test Appreciator left

Before stimulus & During stimulus Left side data: Statistics=-1.415, p=0.168 Same distribution (fail to reject H0)

Before stimulus & After stimulus Left side data: Statistics=0.594, p=0.557 Same distribution (fail to reject H0)

During stimulus & After stimulus Left side data: Statistics=1.803, p=0.082 Same distribution (fail to reject H0)

Non-Appreciator Right

```
Before stimulus & During stimulus Right side data:
Statistics=-0.476, p=0.644
Same distribution (fail to reject H0)
```

```
Before stimulus & After stimulus Right side data:
Statistics=-0.955, p=0.360
Same distribution (fail to reject H0)
```

```
During stimulus & After stimulus Right side data:
Statistics=0.830, p=0.424
Same distribution (fail to reject H0)
```

Non-Appreciator Left

```
Before stimulus & During stimulus Left side data:
Statistics=-0.346, p=0.736
Same distribution (fail to reject H0)
```

```
Before stimulus & After stimulus Left side data:
Statistics=-1.018, p=0.331
Same distribution (fail to reject H0)
```

```
During stimulus & After stimulus Left side data:
Statistics=-1.512, p=0.159
Same distribution (fail to reject H0)
```

Annova

```
Right Appreciator

[ ] l = f_right_data.loc[f_right_data['Rating']=='A']['BS - sum']
    m = f_right_data.loc[f_right_data['Rating']=='A']['DS - sum']
    n = f_right_data.loc[f_right_data['Rating']=='A']['AS - sum']

    F, p = scst.f_oneway(l,m,n)
    print('Statistics=%.3f, p=%.3f' % (F, p))

Statistics=0.218, p=0.805

** Left Appreciator

1 = f_left_data.loc[f_left_data['Rating']=='A']['BS - sum']
    m = f_left_data.loc[f_left_data['Rating']=='A']['BS - sum']
    n = f_left_data.loc[f_left_data['Rating']=='A']['AS - sum']

    F, p = scst.f_oneway(l,m,n)
    print('Statistics=%.3f, p=%.3f' % (F, p))

Statistics=0.640, p=0.530
```

```
    Right Non - Appreciator

[] l = f_right_data.loc[f_right_data['Rating']=='N']['BS - sum']
    m = f_right_data.loc[f_right_data['Rating']=='N']['DS - sum']
    n = f_right_data.loc[f_right_data['Rating']=='N']['AS - sum']

    F, p = scst.f_oneway(l,m,n)
    print('Statistics=%.3f, p=%.3f' % (F, p))

    Statistics=0.327, p=0.724

✓ Left Non - Appreciator

② l = f_left_data.loc[f_left_data['Rating']=='N']['D_Loading...]
    m = f_left_data.loc[f_left_data['Rating']=='N']['D_Loading...]
    n = f_left_data.loc[f_left_data['Rating']=='N']['AS - sum']

    F, p = scst.f_oneway(l,m,n)
    print('Statistics=%.3f, p=%.3f' % (F, p))

[- Statistics=0.079, p=0.924
```

Non – Parametric Wilcoxon Test

Appreciator right

```
Before stimulus & During stimulus Right side data:
Statistics=158.000, p=0.198
Same distribution (fail to reject H0)

Before stimulus & After stimulus Right side data:
Statistics=183.000, p=0.456
Same distribution (fail to reject H0)

After stimulus & During stimulus Right side data:
Statistics=195.000, p=0.627
Same distribution (fail to reject H0)
```

```
Before stimulus & During stimulus Left side data:
Statistics=145.000, p=0.117
Same distribution (fail to reject H0)

Before stimulus & After stimulus Left side data:
Statistics=158.000, p=0.198
Same distribution (fail to reject H0)

After stimulus & During stimulus Left side data:
Statistics=135.000, p=0.074
Same distribution (fail to reject H0)
```

Non - Appreciator right

```
Before stimulus & During stimulus Right side data:
Statistics=35.000, p=0.754
Same distribution (fail to reject H0)

Before stimulus & After stimulus Right side data:
Statistics=29.000, p=0.433
Same distribution (fail to reject H0)

After stimulus & During stimulus Right side data:
Statistics=27.000, p=0.347
Same distribution (fail to reject H0)
```

Non - Appreciator left

```
Before stimulus & During stimulus Left side data:
Statistics=37.000, p=0.875
Same distribution (fail to reject H0)

Before stimulus & After stimulus Left side data:
Statistics=33.000, p=0.638
Same distribution (fail to reject H0)

After stimulus & During stimulus Left side data:
Statistics=23.000, p=0.209
Same distribution (fail to reject H0)
```

Man-Whitney Test

Appreciator Right

```
Before stimulus & During stimulus Right side data:
Statistics=393.000, p=0.337
Same distribution (fail to reject H0)

Before stimulus & After stimulus Right side data:
Statistics=402.000, p=0.390
Same distribution (fail to reject H0)

After stimulus & During stimulus Right side data:
Statistics=399.000, p=0.372
Same distribution (fail to reject H0)
```

Appreciator Left

```
Before stimulus & During stimulus Left side data:
Statistics=372.000, p=0.228
Same distribution (fail to reject H0)

Before stimulus & After stimulus Left side data:
Statistics=381.500, p=0.275
Same distribution (fail to reject H0)

After stimulus & During stimulus Left side data:
Statistics=331.000, p=0.083
Same distribution (fail to reject H0)
```

Non - Appreciator Right

```
Before stimulus & During stimulus Right side data:
Statistics=66.500, p=0.386
Same distribution (fail to reject H0)

Before stimulus & After stimulus Right side data:
Statistics=57.000, p=0.201
Same distribution (fail to reject H0)

After stimulus & During stimulus Right side data:
Statistics=58.000, p=0.218
Same distribution (fail to reject H0)
```

Non - Appreciator Left

```
Before stimulus & During stimulus Left side data:
Statistics=71.000, p=0.488
Same distribution (fail to reject H0)

Before stimulus & After stimulus Left side data:
Statistics=71.000, p=0.488
Same distribution (fail to reject H0)

After stimulus & During stimulus Left side data:
Statistics=67.000, p=0.398
Same distribution (fail to reject H0)
```

Asymmetric

T-test Appreciator

Before stimulus & During stimulus: Statistics=-0.147, p=0.884 Same distribution (fail to reject H0)

After stimulus & Before stimulus: Statistics=0.737, p=0.467 Same distribution (fail to reject H0)

After stimulus & During stimulus: Statistics=0.862, p=0.396 Same distribution (fail to reject H0)

Non – Appreciator

Before stimulus & During stimulus: Statistics=-0.491, p=0.633 Same distribution (fail to reject H0)

After stimulus & Before stimulus: Statistics=-1.127, p=0.284 Same distribution (fail to reject H0)

After stimulus & During stimulus: Statistics=-1.124, p=0.285 Same distribution (fail to reject H0)

<u>Annova</u>

```
[ ] l = total_data.loc[total_data['Rating']=='A']['BS - sum']
    m = total_data.loc[total_data['Rating']=='A']['DS - sum']
    n = total_data.loc[total_data['Rating']=='A']['AS - sum']

    F, p = scst.f_oneway(l,m,n)
    print('Statistics=%.3f, p=%.3f' % (F, p))

Statistics=0.086, p=0.917

1 = total_data.loc[total_data['Rating']=='N']['BS - sum']
    m = total_data.loc[total_data['Rating']=='N']['DS - sum']
    n = total_data.loc[total_data['Rating']=='N']['AS - sum']

    F, p = scst.f_oneway(l,m,n)
    print('Statistics=%.3f, p=%.3f' % (F, p))

Statistics=0.198, p=0.822
```

Non Parametric Wilcoxon

Appreciator

```
Before stimulus & During stimulus Right side data:
Statistics=195.000, p=0.627
Same distribution (fail to reject H0)

Before stimulus & After stimulus Right side data:
Statistics=177.000, p=0.381
Same distribution (fail to reject H0)

After stimulus & During stimulus Right side data:
Statistics=161.000, p=0.222
Same distribution (fail to reject H0)
```

Non Appreciator

```
Before stimulus & During stimulus Right side data:
Statistics=38.000, p=0.937
Same distribution (fail to reject H0)

Before stimulus & After stimulus Right side data:
Statistics=32.000, p=0.583
Same distribution (fail to reject H0)

After stimulus & During stimulus Right side data:
Statistics=28.000, p=0.388
Same distribution (fail to reject H0)
```

Conclusion:

The F-theta and O-theta data consists of appreciater (Someone who responded significantly to the stimuli) and non appreciater. So their p value would be less than threshold value and this something we found by the results we worked on. Parametric(T-Test) and Non Parametric (Wilcoxon and Mann Whitney) test was undertaken and results of the hypothesis is mentioned below each cell

