

# Cluster mass EEG

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We will explain and apply in R the **Permutation-Based Cluster-Mass** method proposed by Maris and Oostenveld, 2007 and developed in R by Frossard and Renaud, 2018, using EEG data. Finally the **All-Resolution Inference** from Rosenblatt et al. 2018 is applied in order to compute the lower bound for the true discovery proportion inside the clusters computed.

## Packages

First of all, you need to install and load the following packages:

```
#devtools::install_github("angeella/ARIEeg")
#devtools::install_github("bnicenboim/eeguana")
#devtools::install_github("jaromilfrossard/permuco")
library(ARIEeg)
library(dplyr)
library(eeguana)
library(ggplot2)
library(tidyr)
library(purrr)
library(abind)
library(permuco4brain)
library(hommel)
library(plotly)
library(tidyverse)
```

## Data

The Dataset from the package **ARIEeg** is an **ERP experiment** composed by:

- 20 Subjects,
- 32 Channels
- Stimuli: pictures. Conditions:
  1. (f): fear (face)
  2. (h): happiness (face)
  3. (d): disgust (face)
  4. (n): neutral (face)
  5. (o): object

We have one observation for each subject and each stimulus. You can load it using:

```
load(system.file("extdata", "data_eeg_emotion.RData", package = "ARIEeg"))
```

We transform the data as **eeg\_lst** class object from the package **eeguana**:

```
data = utilsT0lst(data=dati)
is_eeg_lst(data)
```

```
## [1] TRUE
```

and we drop off the final 5 channels:

```
chan_to_rm <- c("RM" , "EOGvo" ,"EOGvu"  
              , "EOGhl" , "EOGhr")  
  
data <-  
  data %>%  
  select(-one_of(chan_to_rm))
```

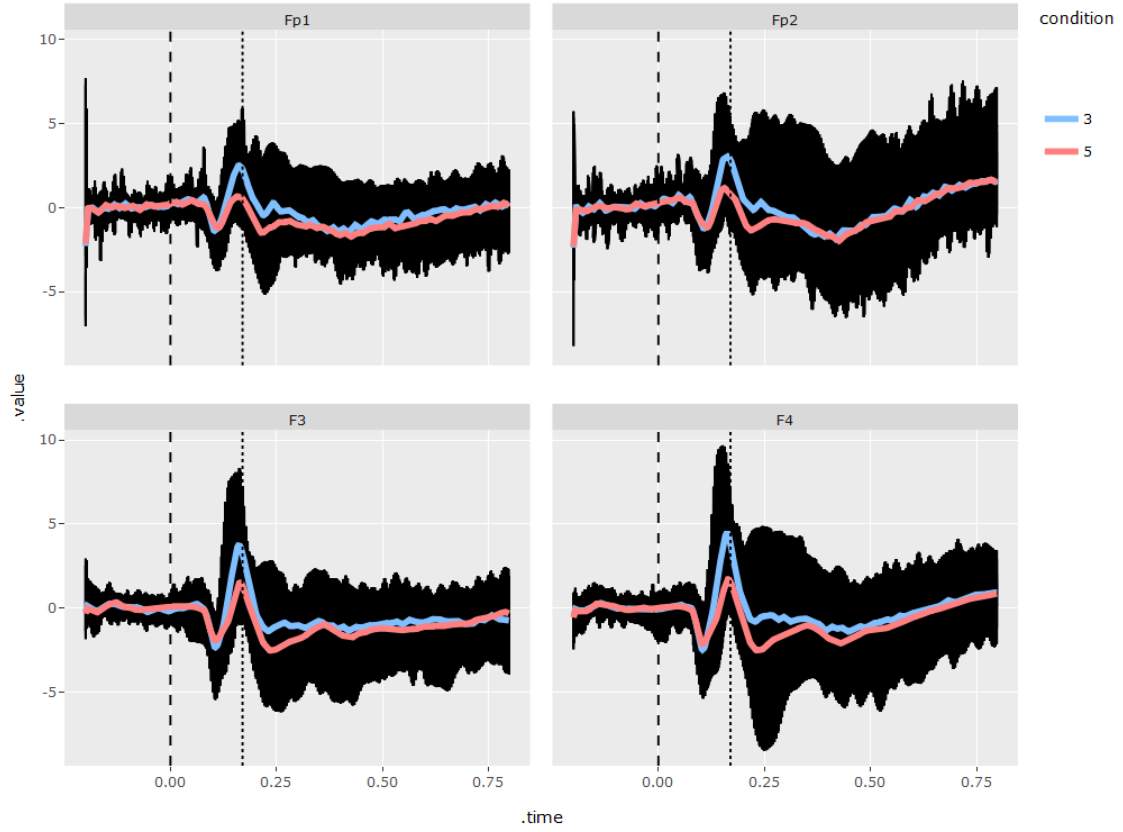
Finally, we segment the data and select two conditions, i.e., **disgust face** and **object**:

```
data_seg <- data %>%  
  eeg_segment(.description %in% c(3,5),  
             lim = c(min(dati$timings$time), max(dati$timings$time))  
  ) %>% eeg_baseline() %>%  
  mutate(  
    condition =  
      description  
  ) %>%  
  select(-c(type,description))
```

Some plot to understand the global mean difference between the two conditions:

```
A<-data_seg %>%  
  select(Fp1,Fp2, F3, F4) %>%  
  ggplot(aes(x = .time, y = .value)) +  
  geom_line(aes(group = condition)) +  
  stat_summary(  
    fun = "mean", geom = "line", alpha = 1, size = 1.5,  
    aes(color = condition),show.legend = TRUE  
  ) +  
  facet_wrap(~.key) +  
  geom_vline(xintercept = 0, linetype = "dashed") +  
  geom_vline(xintercept = .17, linetype = "dotted") +  
  theme(legend.position = "bottom")+  
  scale_color_manual(labels = c("Disgust", "Object"), values = c("#80bfff", "#ff8080"))  
ggp <- ggplotly(A)%>% layout(margin = list(r = 90))  
tmpFile <- tempfile(fileext = ".png")  
export(ggp, file = tmpFile)
```

```
## Warning: 'export' is deprecated.  
## Use 'orca' instead.  
## See help("Deprecated")
```



## Analysis

### Multiple testing problem?

The aim is to test if the difference of brain signal during the two conditions is different from 0 for each time points, i.e., 500, and for each channel, i.e., 27. Therefore, we have  $500 \cdot 27$  statistical tests to perform at group-level, so considering the **random subject effect**. The multiple testing problem is then obvious, and correction methods as Bonferroni or similar don't capture the time-spatial correlation structure of the statistical tests, the cluster mass method, proposed by Maris and Oostenveld, 2007, is then used. It is based on **permutation theory**, and it gains some power respect to other procedure correcting at level of spatial-temporal cluster instead of at level of single tests. It is similar to the cluster mass in the fMRI framework, but in this case, the *voxels*, i.e., the single object of the analysis, are expressed in terms of combination time-points/channels. The method is then able to gain some power respect to some traditional conservative FWER correction method exploiting the spatial-temporal structure of the data.

### Repeated Measures Anova Model

The cluster mass method is based on the **Repeated Measures Anova**, i.e.,

$$y = \mathbb{1}_{N \times 1} \mu + \eta X^\eta + \pi X^\pi + \eta \pi X^{\eta\pi} + \epsilon$$

where  $\mathbb{1}_{N \times 1}$  is a matrix with ones and

1.  $\mu$  is the **intercept**;
2.  $y \in \mathbb{R}^{N \times 1}$  is the response variables, i.e., the **signal**, in our case  $N = n_{subj} \times n_{stimuli} = 40$ ;

3.  $X^\eta \in \mathbb{R}^{N \times n_{stimuli}}$  is the **design matrix** describing the **fixed effect** regarding the stimuli, and  $\eta \in \mathbb{R}^{n_{stimuli} \times 1}$  the corresponding parameter of interest;
4.  $X^\pi \in \mathbb{R}^{N \times n_{subj}}$  is the **design matrix** describing the **random effect** regarding the subjects, and  $\pi \in \mathbb{R}^{n_{subj} \times 1}$  the corresponding parameter.
5.  $X^{\eta\pi}$  is the **design matrix** describing the **interaction effects** between subjects and conditions;
6.  $\epsilon \in \mathbb{R}^{N \times 1}$  is the **error term** with 0 mean and variance  $\sigma^2 I_N$ .

Therefore,  $y \sim (\mathbb{K}\mu + X^\eta\eta, \Sigma)$ ,  $\pi \sim (0, \sigma_\pi^2 I_{n_{subj}})$  and  $\eta\pi \sim (0, \text{cov}(\eta\pi))$ .

We want to make inference on  $\eta$ , such that  $H_0 : \eta = 0$  vs  $H_1 : \eta \neq 0$ . We do that using the **F statistic**, i.e.,

$$F = \frac{y^\top H_{X^\eta} y / (n_{stimuli} - 1)}{y^\top H_{X^{\eta\pi}} y / (n_{stimuli} - 1)(n_{subj} - 1)}$$

where  $H_X$  is the **projection matrix**, i.e.,  $H_X = X(X^\top X)^{-1}X^\top$ . In order to compute this test, we use an alternative definition of  $F$  based on the residuals:

$$F = \frac{r^\top H_{X^\eta} r / (n_{stimuli} - 1)}{r^\top H_{X^{\eta\pi}} r / (n_{stimuli} - 1)(n_{subj} - 1)}$$

where  $r = (H_{X^\eta} + H_{X^{\eta\pi}})y$ . For further details, see Kherad Pajouh and Renaud, 2014.

So, let the group of permutation, including the identity transformation,  $\mathcal{P}$ , we use  $r^* = Pr$ , where  $P \in \mathcal{P}$  to compute the null distribution of our test, i.e.,  $\mathcal{R}$ , and then the p-value, i.e.,

$$\text{p-value} = \frac{1}{B} \sum_{r_b^* \in \mathcal{R}} \mathbb{I}(|r_b^*| \geq |r|)$$

if the two-tailed is considered.

We have this model for each time point  $t \in \{1, \dots, 500\}$  and each channel, so finally we will have  $n_{\text{time-points}} \times n_{\text{channels}}$  statistical tests/p-values (raw).

## Spatio-temporal Cluster mass

Then, we need to construct the **spatial-temporal clusters** in order to correct the raw p-values for the FWER. In this case, we will use the theory of graph, where the vertices represent the channels, and the edges represent the **adjacency** relationship. The adjacency must be defined using prior information, therefore the three-dimensional Euclidean distance between channels is used. Two channels are defined adjacent if their Euclidean distance is less than a threshold  $\delta$ , where  $\delta$  is the smallest euclidean distance that produces a connected graph. This is due to the fact that a connected graph implies no disconnected sub-graph. Having sub-graphs implies that some tests cannot, by design, be in the same cluster, which is not a useful assumption for this analysis. (Frossard and Renaud, 2018; Frossard, 2019).

Then, having the spatial adjacency definition, we need to define the temporal one. We reproduce this graph  $n_{\text{time-points}}$  times, the edges between all pairs of two vertices (tests) are associated with the same electrode when they are temporally adjacent. The final graph has a total of vertices equals to the number of tests ( $n_{\text{channels}} \times n_{\text{time-points}}$ ). The following figure represents the case of 64 channels and 3 temporal measures:

We then delete all the vertices in which statistics are below a threshold, e.g., the 95 percentile of the null distribution of the  $F$  statistics. So, we have a new graph composed of **multiple connected components**. Then, each connected component is interpreted as a spatiotemporal cluster. Finally, for each connected component, we compute the cluster-mass statistic using the sum (or sum of squares) of statistics of that particular connected component.

The cluster-mass null distribution is computed by permutations while maintaining spatio-temporal correlations among tests. Permutations must be performed without changing the position of electrodes nor mixing time-points. Concretely, after transforming the responses using the permutation method

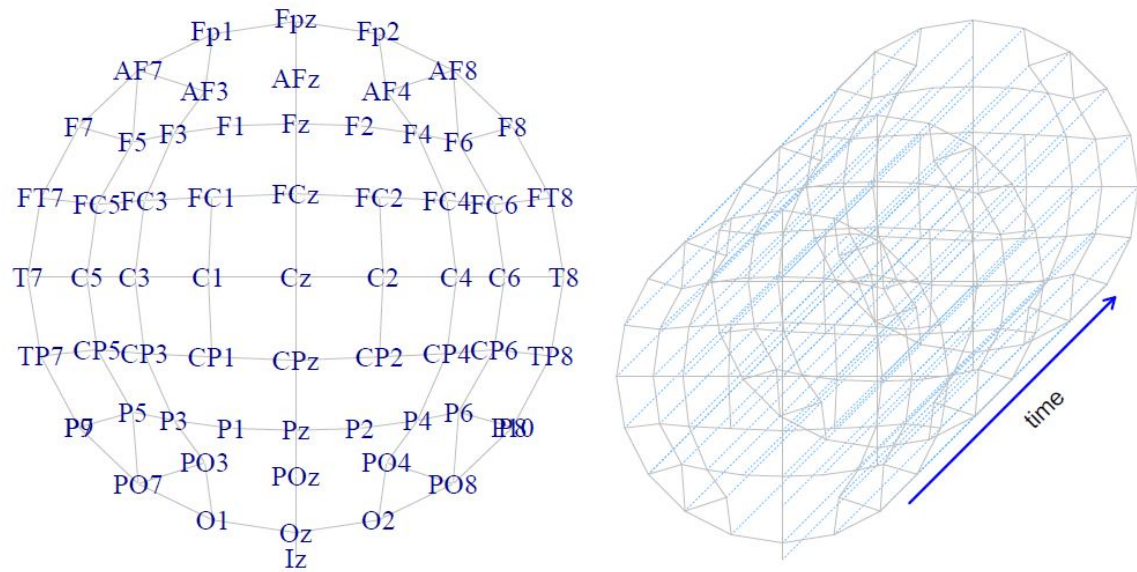


Figure 1: Example of graph of adjacency from Frossard, 2019

in Kherad Pajouh and Renaud, 2014, they are sorted in a three-dimensional array. It has the design (subjects  $\times$  stimuli) in the first dimension, time in the second one and electrodes in the third one. Then, only the first dimension is permuted to create a re-sampled response (or 3D array). Doing so, it does not reorder time-points, neither electrodes, therefore, the spatiotemporal correlations are maintained within each permuted sample.

## Permucobrain

In R, all of this is possible thanks to the `permuco` and `permuco4brain` packages developed by Frossard and Renaud, 2018.

1. Construct the  $y$ . We need to construct the three-dimensional **signal array**, having dimensions  $40 \times 500 \times 27$ :

```
signal <-
  data_seg %>%
  signal_tbl() %>%
  group_by(.id) %>%
  nest() %>%
  mutate(data = map(data, ~as.matrix(.x[-1]))) %>%
  pull(data) %>%
  invoke(abind, ., along = 3) %>%
  aperm(c(3,1,2))

dim(signal)
```

```
## [1] 40 500 27
```

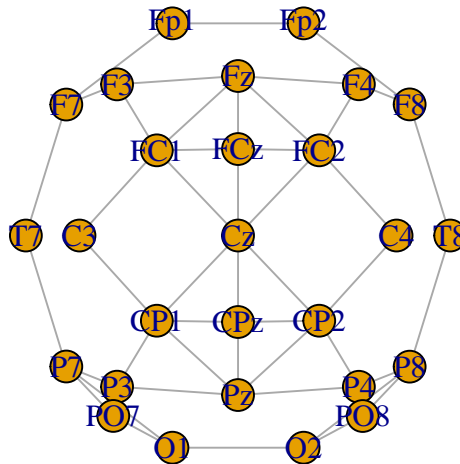
2. Construct the  $X_{\eta\pi}$ :

```
design <-
  segments_tbl(data_seg) %>%
  select(.subj, condition)
dim(design)
```

```
## [1] 40 2
```

3. Construct the **graph**, using  $\delta = 53mm$ :

```
graph <- position_to_graph(channels_tbl(data_seg), name = .channel, delta = 53,
                           x = .x, y = .y, z = .z)
plot(graph)
```



4. Define the **repeated measures ANOVA** formula:

```
f <- signal ~ condition + Error(.subj/(condition))
```

Finally, run the main function:

```
model <- permuco4brain::brainperm(formula = f,
                                   data = design,
                                   graph = graph,
                                   np = 5000,
                                   multcomp = "clustermass",
                                   return_distribution = TRUE)
```

```
## Computing Effect:
## 1 (condition) of 1. Start at 2020-05-17 12:34:57.
```

where np indicates the number of permutation.

Then, we can analyze the output:

```
print(model)
```

```
## Effect: condition.
## Alternative Hypothesis: two.sided.
## Statistic: fisher(1, 19).
## Resample Method: Rd_kheradPajouh_renaud.
## Number of Dependant Variables: 13500.
## Type of Resample: permutation.
## Number of Resamples: 5000.
```

```

## Multiple Comparisons Procedure: clustermass.
## Threshold: 4.38075.
## Mass Function: the sum.
## Table of clusters.
##
##      Cluster id First sample Last sample N. chan. Main chan. Main chan. length
## 1          1          1          4          3          Fz          4
## 2          2          2          6          2          02          5
## 3          3          3          6          1          F7          4
## 4          4         10         10          1          F8          1
## 5          5         18         19          1          Pz          2
## 6          6         25         27          1          T7          3
## 7          7         29         30          1          F8          2
## 8          8         38         41          1          F3          4
## 9          9         39         41          2          Pz          3
## 10         10         40         40          1         Fp1          1
## 11         11         40         44          1          T7          5
## 12         12         45         49          1          F4          5
## 13         13         46         48          1         Fp1          3
## 14         14         47         49          1          P4          3
## 15         15         48         49          1          C4          2
## 16         16         51         52          1          T7          2
## 17         17         61         68          3          P3          8
## 18         18         70         75          3         P08          6
## 19         19         71         73          1         Fp2          3
## 20         20         83         86          1          C4          4
## 21         21         83         88          2          T7          6
## 22         22         96        105          4        F3 (2)          8
## 23         23        101        108          3        02 (2)          6
## 24         24        110        117          6        C3 (2)          8
## 25         25        115        117          1          P8          3
## 26         26        125        126          1          F7          2
## 27         27        128        137          4          P8          9
## 28         28        133        135          2          C3          3
## 29         29        136        139          2         Fp1          4
## 30         30        137        139          2         P07          3
## 31         31        142        144          1         Fp1          3
## 32         32        146        500         27          P7        343
## 33         33        148        157          8        C4 (3)          9
## 34         34        148        152          1          P7          5
## 35         35        153        154          1         Fp1          2
## 36         36        314        320          1         Fp1          7
## 37         37        336        341          1         Fp1          6
## 38         38        351        352          1         Fp1          2
## 39         39        363        367          1         Fp1          5
## 40         40        376        383          1         Fp1          8
## 41         41        408        421          1         Fp1         14
##      N. test  Clustermass P(>mass)
## 1          8 4.824842e+01 0.9956
## 2          8 5.655352e+01 0.9942
## 3          4 2.161425e+01 0.9998
## 4          1 4.595571e+00 1.0000
## 5          2 9.160799e+00 1.0000
## 6          3 1.727826e+01 0.9998
## 7          2 9.953708e+00 1.0000
## 8          4 2.247954e+01 0.9998
## 9          4 1.841798e+01 0.9998
## 10         1 5.834359e+00 1.0000

```

## 11	5	3.514078e+01	0.9980
## 12	5	3.062193e+01	0.9986
## 13	3	1.562175e+01	1.0000
## 14	3	1.855438e+01	0.9998
## 15	2	1.046127e+01	1.0000
## 16	2	1.091898e+01	1.0000
## 17	13	9.673299e+01	0.9768
## 18	16	9.924648e+01	0.9756
## 19	3	1.701493e+01	0.9998
## 20	4	2.614448e+01	0.9998
## 21	10	7.604927e+01	0.9866
## 22	26	1.750308e+02	0.9324
## 23	17	1.039216e+02	0.9726
## 24	35	2.762222e+02	0.8736
## 25	3	1.367199e+01	1.0000
## 26	2	9.355923e+00	1.0000
## 27	27	1.703500e+02	0.9338
## 28	5	2.598810e+01	0.9998
## 29	6	3.007729e+01	0.9986
## 30	4	1.807287e+01	0.9998
## 31	3	1.823876e+01	0.9998
## 32	4788	1.041780e+05	0.0002
## 33	54	4.224551e+02	0.7810
## 34	5	3.646500e+01	0.9976
## 35	2	9.661613e+00	1.0000
## 36	7	5.632912e+01	0.9942
## 37	6	3.530033e+01	0.9980
## 38	2	9.153198e+00	1.0000
## 39	5	2.908355e+01	0.9990
## 40	8	6.388484e+01	0.9916
## 41	14	8.033085e+01	0.9838

We have only one significant cluster (32), with p-value equals to 0.0002. It is composed by 27 channels (the total set), with main channels P7. You can see in details the components of this cluster in

##	[1]	"O2_146"	"O2_147"	"O2_148"	"O2_149"	"O2_150"	"O2_151"	"Pz_151"
##	[8]	"O2_152"	"Pz_152"	"O1_153"	"O2_153"	"Pz_153"	"O1_154"	"O2_154"
##	[15]	"Pz_154"	"O1_155"	"O2_155"	"Pz_155"	"O1_156"	"O2_156"	"Pz_156"
##	[22]	"O1_157"	"O2_157"	"Pz_157"	"P7_158"	"O1_158"	"Pz_158"	"P7_159"
##	[29]	"O1_159"	"Pz_159"	"F4_160"	"P7_160"	"P07_160"	"Pz_160"	"Fp1_161"
##	[36]	"Fp2_161"	"F4_161"	"C4_161"	"T7_161"	"CP2_161"	"P7_161"	"P07_161"
##	[43]	"Pz_161"	"Fp1_162"	"Fp2_162"	"F4_162"	"F7_162"	"F8_162"	"FC2_162"
##	[50]	"C4_162"	"T7_162"	"CP2_162"	"P7_162"	"P8_162"	"P07_162"	"Cz_162"
##	[57]	"CPz_162"	"Pz_162"	"Fp1_163"	"Fp2_163"	"F4_163"	"F8_163"	"FC2_163"
##	[64]	"C4_163"	"T7_163"	"CP2_163"	"P7_163"	"P8_163"	"P07_163"	"Fz_163"
##	[71]	"FCz_163"	"Cz_163"	"CPz_163"	"Pz_163"	"Fp1_164"	"Fp2_164"	"F4_164"
##	[78]	"F8_164"	"FC1_164"	"FC2_164"	"C4_164"	"T7_164"	"CP2_164"	"P7_164"
##	[85]	"P8_164"	"P07_164"	"P08_164"	"Fz_164"	"FCz_164"	"Cz_164"	"CPz_164"
##	[92]	"Pz_164"	"Fp1_165"	"Fp2_165"	"F3_165"	"F4_165"	"F8_165"	"FC1_165"
##	[99]	"FC2_165"	"C4_165"	"T7_165"	"CP1_165"	"CP2_165"	"P7_165"	"P8_165"
##	[106]	"P07_165"	"P08_165"	"O1_165"	"O2_165"	"Fz_165"	"FCz_165"	"Cz_165"
##	[113]	"CPz_165"	"Pz_165"	"Fp1_166"	"Fp2_166"	"F3_166"	"F4_166"	"F8_166"
##	[120]	"FC1_166"	"FC2_166"	"C4_166"	"T7_166"	"CP1_166"	"CP2_166"	"P7_166"
##	[127]	"P8_166"	"P07_166"	"P08_166"	"O1_166"	"O2_166"	"Fz_166"	"FCz_166"
##	[134]	"Cz_166"	"CPz_166"	"Pz_166"	"Fp1_167"	"Fp2_167"	"F3_167"	"F4_167"
##	[141]	"F8_167"	"FC1_167"	"FC2_167"	"C3_167"	"C4_167"	"T7_167"	"CP1_167"
##	[148]	"CP2_167"	"P7_167"	"P8_167"	"P07_167"	"P08_167"	"O1_167"	"O2_167"
##	[155]	"Fz_167"	"FCz_167"	"Cz_167"	"CPz_167"	"Pz_167"	"Fp1_168"	"Fp2_168"
##	[162]	"F3_168"	"F4_168"	"F8_168"	"FC1_168"	"FC2_168"	"C3_168"	"C4_168"



```

## [169] "T7_168" "CP1_168" "CP2_168" "P7_168" "P8_168" "P07_168" "P08_168"
## [176] "O1_168" "O2_168" "Fz_168" "FCz_168" "Cz_168" "CPz_168" "Pz_168"
## [183] "Fp1_169" "Fp2_169" "F3_169" "F4_169" "F8_169" "FC1_169" "FC2_169"
## [190] "C3_169" "C4_169" "T7_169" "CP1_169" "CP2_169" "P7_169" "P8_169"
## [197] "P07_169" "P08_169" "O1_169" "O2_169" "Fz_169" "FCz_169" "Cz_169"
## [204] "CPz_169" "Pz_169" "Fp1_170" "Fp2_170" "F3_170" "F4_170" "F8_170"
## [211] "FC1_170" "FC2_170" "C3_170" "C4_170" "T7_170" "CP1_170" "CP2_170"
## [218] "P7_170" "P8_170" "P07_170" "P08_170" "O1_170" "O2_170" "Fz_170"
## [225] "FCz_170" "Cz_170" "CPz_170" "Pz_170" "Fp1_171" "Fp2_171" "F3_171"
## [232] "F4_171" "F8_171" "FC1_171" "FC2_171" "C3_171" "C4_171" "T7_171"
## [239] "CP1_171" "CP2_171" "P7_171" "P8_171" "P07_171" "P08_171" "O1_171"
## [246] "O2_171" "Fz_171" "FCz_171" "Cz_171" "CPz_171" "Pz_171" "Fp1_172"
## [253] "Fp2_172" "F3_172" "F4_172" "F8_172" "FC1_172" "FC2_172" "C3_172"
## [260] "C4_172" "T7_172" "T8_172" "CP1_172" "CP2_172" "P7_172" "P8_172"
## [267] "P07_172" "P08_172" "O1_172" "O2_172" "Fz_172" "FCz_172" "Cz_172"
## [274] "CPz_172" "Pz_172" "Fp1_173" "Fp2_173" "F3_173" "F4_173" "F8_173"
## [281] "FC1_173" "FC2_173" "C3_173" "C4_173" "T7_173" "T8_173" "CP1_173"
## [288] "CP2_173" "P7_173" "P8_173" "P07_173" "P08_173" "O1_173" "O2_173"
## [295] "Fz_173" "FCz_173" "Cz_173" "CPz_173" "Pz_173" "Fp1_174" "Fp2_174"
## [302] "F3_174" "F4_174" "F7_174" "F8_174" "FC1_174" "FC2_174" "C3_174"
## [309] "C4_174" "T7_174" "T8_174" "CP1_174" "CP2_174" "P7_174" "P8_174"
## [316] "P07_174" "P08_174" "O1_174" "O2_174" "Fz_174" "FCz_174" "Cz_174"
## [323] "CPz_174" "Pz_174" "Fp1_175" "Fp2_175" "F3_175" "F4_175" "F7_175"
## [330] "F8_175" "FC1_175" "FC2_175" "C3_175" "C4_175" "T7_175" "T8_175"
## [337] "CP1_175" "CP2_175" "P7_175" "P8_175" "P07_175" "P08_175" "O1_175"
## [344] "O2_175" "Fz_175" "FCz_175" "Cz_175" "CPz_175" "Pz_175" "Fp1_176"
## [351] "Fp2_176" "F3_176" "F4_176" "F7_176" "F8_176" "FC1_176" "FC2_176"
## [358] "C3_176" "C4_176" "T7_176" "T8_176" "CP1_176" "CP2_176" "P7_176"
## [365] "P8_176" "P07_176" "P08_176" "O1_176" "O2_176" "Fz_176" "FCz_176"
## [372] "Cz_176" "CPz_176" "Pz_176" "Fp1_177" "Fp2_177" "F3_177" "F4_177"
## [379] "F7_177" "F8_177" "FC1_177" "FC2_177" "C3_177" "C4_177" "T7_177"
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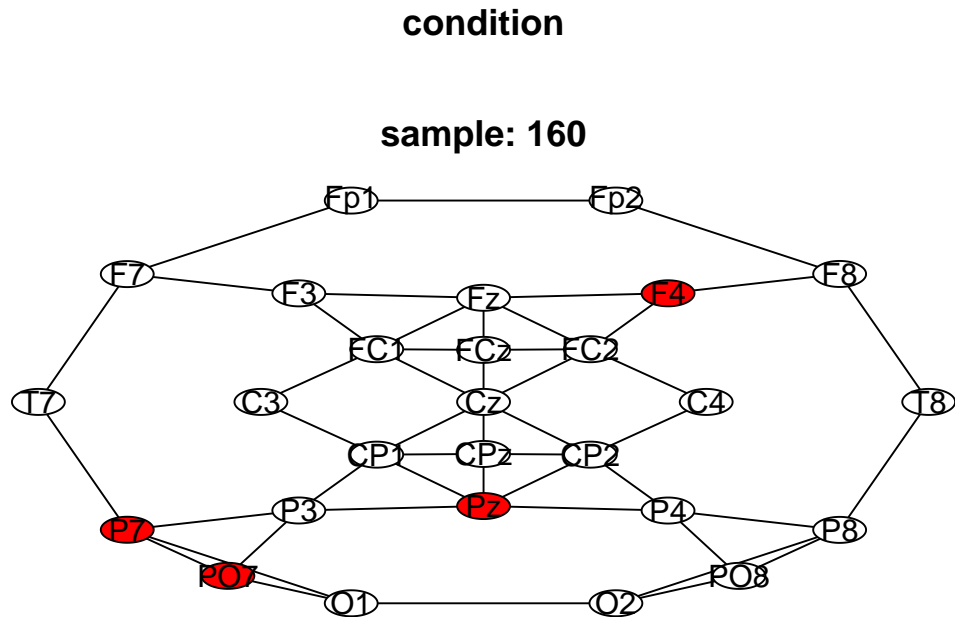
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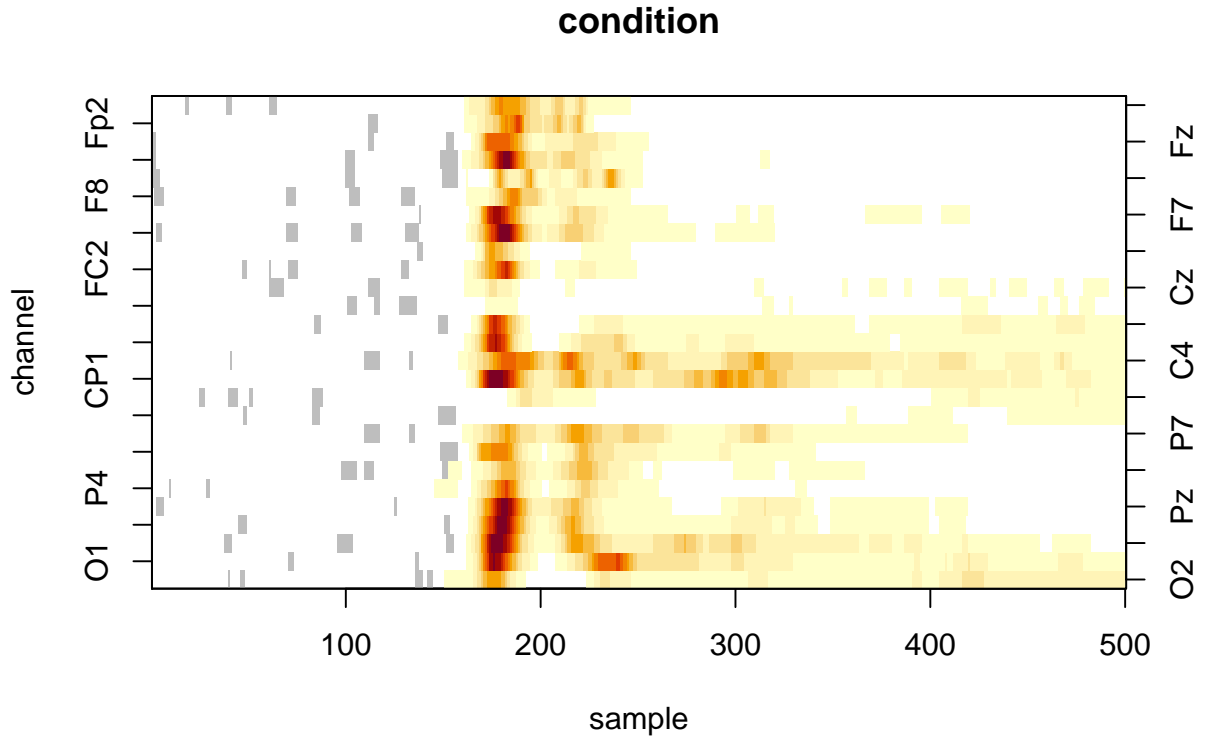
You can see the significant cluster (in red) at fixed time points (e.g. 160) using plot:

```
plot(model, samples = 160)
```



and the significant cluster over time and over channels using:

```
image(model)
```



where the significant clusters are represented in a colour-scale and the non-significant one in grey. The white pixels are tests which statistic are below the threshold.

## ARI in EEG cluster mass

However, our significant cluster (11) says only that at least one combination channels/time-points is different from 0, we don't know how many combinations are significant (**spatial specificity paradox**). So, we can apply ARI to understand the lower bound of the number of true discovery proportion:

```
ARIEeg(model = model)
```

##	ID	Total	clustermass	pvalue	False	Null	True	Null	Active	Proportion
##	[1,]	1	8	4.824842e+01	0.9956		0	8		0.0000000
##	[2,]	2	8	5.655352e+01	0.9942		0	8		0.0000000
##	[3,]	3	4	2.161425e+01	0.9998		0	4		0.0000000
##	[4,]	4	1	4.595571e+00	1.0000		0	1		0.0000000
##	[5,]	5	2	9.160799e+00	1.0000		0	2		0.0000000
##	[6,]	6	3	1.727826e+01	0.9998		0	3		0.0000000
##	[7,]	7	2	9.953708e+00	1.0000		0	2		0.0000000
##	[8,]	8	4	2.247954e+01	0.9998		0	4		0.0000000
##	[9,]	9	4	1.841798e+01	0.9998		0	4		0.0000000
##	[10,]	10	1	5.834359e+00	1.0000		0	1		0.0000000
##	[11,]	11	5	3.514078e+01	0.9980		0	5		0.0000000
##	[12,]	12	5	3.062193e+01	0.9986		0	5		0.0000000
##	[13,]	13	3	1.562175e+01	1.0000		0	3		0.0000000
##	[14,]	14	3	1.855438e+01	0.9998		0	3		0.0000000
##	[15,]	15	2	1.046127e+01	1.0000		0	2		0.0000000
##	[16,]	16	2	1.091898e+01	1.0000		0	2		0.0000000
##	[17,]	17	13	9.673299e+01	0.9768		0	13		0.0000000
##	[18,]	18	16	9.924648e+01	0.9756		0	16		0.0000000

## [19,]	19	3	1.701493e+01	0.9998	0	3	0.0000000
## [20,]	20	4	2.614448e+01	0.9998	0	4	0.0000000
## [21,]	21	10	7.604927e+01	0.9866	0	10	0.0000000
## [22,]	22	26	1.750308e+02	0.9324	0	26	0.0000000
## [23,]	23	17	1.039216e+02	0.9726	0	17	0.0000000
## [24,]	24	35	2.762222e+02	0.8736	0	35	0.0000000
## [25,]	25	3	1.367199e+01	1.0000	0	3	0.0000000
## [26,]	26	2	9.355923e+00	1.0000	0	2	0.0000000
## [27,]	27	27	1.703500e+02	0.9338	0	27	0.0000000
## [28,]	28	5	2.598810e+01	0.9998	0	5	0.0000000
## [29,]	29	6	3.007729e+01	0.9986	0	6	0.0000000
## [30,]	30	4	1.807287e+01	0.9998	0	4	0.0000000
## [31,]	31	3	1.823876e+01	0.9998	0	3	0.0000000
## [32,]	32	4788	1.041780e+05	0.0002	750	4038	0.1566416
## [33,]	33	54	4.224551e+02	0.7810	0	54	0.0000000
## [34,]	34	5	3.646500e+01	0.9976	0	5	0.0000000
## [35,]	35	2	9.661613e+00	1.0000	0	2	0.0000000
## [36,]	36	7	5.632912e+01	0.9942	0	7	0.0000000
## [37,]	37	6	3.530033e+01	0.9980	0	6	0.0000000
## [38,]	38	2	9.153198e+00	1.0000	0	2	0.0000000
## [39,]	39	5	2.908355e+01	0.9990	0	5	0.0000000
## [40,]	40	8	6.388484e+01	0.9916	0	8	0.0000000
## [41,]	41	14	8.033085e+01	0.9838	0	14	0.0000000

So, we have at least 15% truly active component in the cluster 32.

## References

- Maris, E., & Oostenveld, R. (2007). Nonparametric statistical testing of EEG-and MEG-data. *Journal of neuroscience methods*, 164(1), 177-190.
- Kherad-Pajouh, S., & Renaud, O. (2015). A general permutation approach for analyzing repeated measures ANOVA and mixed-model designs. *Statistical Papers*, 56(4), 947-967.
- Frossard, J. (2019). Permutation tests and multiple comparisons in the linear models and mixed linear models, with extension to experiments using electroencephalography. DOI: 10.13097/archive-ouverte/unige:125617.
- Frossard, J. & O. Renaud (2018). Permucos: Permutation Tests for Regression, (Repeated Measures) ANOVA/ANCOVA and Comparison of Signals. R Packages.