

# Análisis SBM de K&D en FACEHBI

He de hacer un análisis SBM con la variable *kissing & dancing* en los sujetos de FACEHBI. una complejidad añadida es que algunos sujetos son de la V0 y otros de la V2, por lo que me he de montar un proyecto nuevo para el análisis.

## Sacando los datos

Lo primero que tengo que hacer es dividir el archivo de datos entre los que corresponden a V0 y V2.

```
[osotolongo@brick03 kissface]$ head -n 96 kissing_freesurfer.csv > kf0.csv
[osotolongo@brick03 kissface]$ tail -n 31 kissing_freesurfer.csv > kf2.temp
[osotolongo@brick03 kissface]$ head -n 1 kissing_freesurfer.csv >
kheader.txt6
[osotolongo@brick03 kissface]$ cat kheader.txt6 kf2.temp > kf2.csv
[osotolongo@brick03 kissface]$ rm kf2.temp kheader.txt6
```

Ahora saco los experimentos de XNAT

```
[osotolongo@brick03 kissface]$ for x in $(awk -F"," '{print $1}' kf0.csv |
grep -v facehbi); do e=$(xnatopic list_experiments --project_id facehbi --
subject_id ${x} --modality MRI); echo "${x},${e}"; done >
kf0_experiments.csv
[osotolongo@brick03 kissface]$ for x in $(awk -F"," '{print $1}' kf2.csv |
grep -v facehbi); do e=$(xnatopic list_experiments --project_id f2cehbi --
subject_id ${x} --modality MRI); echo "${x},${e}"; done >
kf2_experiments.csv
[osotolongo@brick03 kissface]$ head kf0_experiments.csv
F113,XNAT4_E00269
F115,XNAT4_E00270
F116,XNAT4_E00271
F117,XNAT4_E00272
F118,XNAT4_E00273
F119,XNAT4_E00274
F120,XNAT4_E00275
F121,XNAT4_E00276
F122,XNAT4_E00277
F123,XNAT4_E00278
[osotolongo@brick03 kissface]$ head kf2_experiments.csv
F216,XNAT5_E00259
F217,XNAT5_E00260
F218,XNAT5_E00261
F219,XNAT5_E00262
F220,XNAT5_E00263
F221,XNAT5_E00264
F222,XNAT5_E00265
F223,XNAT5_E00266
```

```
F224,XNAT5_E00267
F225,XNAT5_E00268
[osotolongo@brick03 kissface]$ wc -l kf0_experiments.csv kf2_experiments.csv
 95 kf0_experiments.csv
 30 kf2_experiments.csv
125 total
```

y ahora me bajo los resultados,

```
[osotolongo@brick03 kissface]$ mkdir tmp
[osotolongo@brick03 kissface]$ for x in $(cat kf0_experiments.csv); do
sbj=$(echo $x | awk -F"," '{print $1}'); xxp=$(echo $x | awk -F"," '{print
$2}'); mkdir fsresults/${sbj}; xnatapic get_fsresults --experiment_id ${xxp}
--all-tgz tmp/;tar xzvf tmp/*.tar.gz -C fsresults/${sbj}/ --
exclude='fsaverage' --strip-components=1; rm tmp/*.tar.gz; done
[osotolongo@brick03 kissface]$ for x in $(cat kf2_experiments.csv); do
sbj=$(echo $x | awk -F"," '{print $1}'); xxp=$(echo $x | awk -F"," '{print
$2}'); mkdir fsresults/${sbj}; xnatapic get_fsresults --experiment_id ${xxp}
--all-tgz tmp/;tar xzvf tmp/*.tar.gz -C fsresults/${sbj}/ --
exclude='fsaverage' --strip-components=1; rm tmp/*.tar.gz; done
```

Antes de seguir, comprobamos que este todo,

```
[osotolongo@brick03 kissface]$ for x in $(cat kf2_experiments.csv); do
sbj=$(echo $x | awk -F"," '{print $1}'); xxp=$(echo $x | awk -F"," '{print
$2}'); ls -d fsresults/${sbj}/mri; done | wc -l
ls: cannot access fsresults/F216/mri: No such file or directory
29
```

y *no deberia*, pero alguno falta, estos los enviamos a procesar a ver que pasa,

```
[osotolongo@brick03 kissface]$ xnatapic run_pipeline --project_id f2cehbi --
pipeline RunFreesurfer --experiment_id XNAT5_E00259
[osotolongo@brick03 kissface]$ queue | grep xnat
163268      fast RunFrees      xnat R      2:02      1 brick05
```

## Montando el proyecto

```
[osotolongo@brick03 kissface]$ ls fsresults/ | cat -n | awk
'{printf("%04d;%s\n", $1, $2)}' > kissface_mri.csv
[osotolongo@brick03 kissface]$ for x in `cat kissface_mri.csv`; do
trg=$(echo ${x} | awk -F";" '{print $2}'); dst=$(echo ${x} | awk -F";"
'{print $1}'); mkdir /nas/data/subjects/kissface_${dst}; cp -r
fsresults/${trg}/* /nas/data/subjects/kissface_${dst}/; done
```

Se supone que ahora ya lo tengo todo copiado en su sitio.

## Armando la DB

```
[osotolongo@brick03 kissface]$ sed 's/;/,/' kissface_mri.csv | sed
'liSubject,PSubject' > kissface_codes.csv
[osotolongo@brick03 kissface]$ sed 's/facehbi_id_fac/PSubject;/s/,,$/'
kissing_freesurfer.csv > kissing_clean.csv
[osotolongo@brick03 kissface]$ for x in fsresults/*; do icv=$(grep
"EstimatedTotalIntraCranialVol" ${x}/stats/aseg.stats | awk -F"," '{print
$4}' | sed 's/^ //''); echo "${x},${icv}" | sed 's/fsresults\\//'; done | sed
'liPSubject,EstimatedTotalIntraCranialVol' > kissface_raw_icv.csv
[osotolongo@brick03 kissface]$ head kissface_raw_icv.csv
PSubject,EstimatedTotalIntraCranialVol
F113,1327300.818871
F115,1825737.153699
F116,1591088.289640
F117,1555151.958621
F118,1392708.812305
F119,1815452.525813
F120,1672391.014925
F121,1415862.242416
F122,1333443.454197
```

Esto lo voy a convertir a z-scores,

[convert\\_icv.r](#)

```
setwd("/nas/data/kissface")
read.csv("kissface_raw_icv.csv") -> x
xzICV <- (x$EstimatedTotalIntraCranialVol -
mean(x$EstimatedTotalIntraCranialVol))/sd(x$EstimatedTotalIntraCranialVol)
write.csv(x, file="kissface_zicv.temp", row.names=FALSE)
```

asi,

```
[osotolongo@brick03 kissface]$ Rscript convert_icv.r
[osotolongo@brick03 kissface]$ head kissface_zicv.temp
"PSubject","EstimatedTotalIntraCranialVol","zICV"
"F113",1327300.818871,-1.07341914119678
"F115",1825737.153699,2.33416070384843
"F116",1591088.28964,0.729974403694122
"F117",1555151.958621,0.48429424611196
"F118",1392708.812305,-0.626254790292351
"F119",1815452.525813,2.26384943589037
"F120",1672391.014925,1.28580372164305
"F121",1415862.242416,-0.467965443635606
"F122",1333443.454197,-1.0314247702616
[osotolongo@brick03 kissface]$ sed 's/"/"/g;' kissface_zicv.temp | awk -F","
```

```
'{print $1","$3}' > kissface_zicv.csv
[osotolongo@brick03 kissface]$ head kissface_zicv.csv
PSubject,zICV
F113,-1.07341914119678
F115,2.33416070384843
F116,0.729974403694122
F117,0.48429424611196
F118,-0.626254790292351
F119,2.26384943589037
F120,1.28580372164305
F121,-0.467965443635606
F122,-1.0314247702616
```

Ahora todo junto,

```
[osotolongo@brick03 kissface]$ join -t, -1 2 -2 1 kissface_codes.csv
kissing_clean.csv > kissing_data_0.csv
[osotolongo@brick03 kissface]$ join -t, kissing_data_0.csv kissface_zicv.csv
> kissface_data.csv
[osotolongo@brick03 kissface]$ head kissface_data.csv
PSubject,Subject,age,sex,years_education_fac,kissing_dancing_words_fac,zICV
F113,0001,79,1,15,50,-1.07341914119678
F115,0002,66,1,19,50,2.33416070384843
F116,0003,55,0,8,50,0.729974403694122
F117,0004,73,0,8,44,0.48429424611196
F118,0005,66,0,12,49,-0.626254790292351
F119,0006,52,1,12,48,2.26384943589037
F120,0007,70,1,23,51,1.28580372164305
F121,0008,73,0,15,50,-0.467965443635606
F122,0009,59,0,10,47,-1.0314247702616
```

## formateando los fsgd

Primero sin ICV,

```
[osotolongo@brick03 kissface]$ awk -F"," '{print
"kissface_"$2","$3","$4","$5","$6}' kissface_data.csv | sed
's/kissface_Subject/Variables/' | sed 's/kissface_\([^,]*\)//Input
kissface_\1 Main /; s/,/ /g' > kissface_body_noicv.csv
[osotolongo@brick03 kissface]$ head kissface_body_noicv.csv
Variables age sex years_education_fac kissing_dancing_words_fac
Input kissface_0001 Main 79 1 15 50
Input kissface_0002 Main 66 1 19 50
Input kissface_0003 Main 55 0 8 50
Input kissface_0004 Main 73 0 8 44
Input kissface_0005 Main 66 0 12 49
Input kissface_0006 Main 52 1 12 48
Input kissface_0007 Main 70 1 23 51
Input kissface_0008 Main 73 0 15 50
```

```

Input kissface_0009 Main 59 0 10 47
[osotolongo@brick03 kissface]$ cat headers.txt kissface_body_noicv.csv >
kissface_noicv.fsgd
[osotolongo@brick03 kissface]$ head kissface_noicv.fsgd
GroupDescriptorFile 1
Title FACEHBI_KD
Class Main
Variables age sex years_education_fac kissing_dancing_words_fac
Input kissface_0001 Main 79 1 15 50
Input kissface_0002 Main 66 1 19 50
Input kissface_0003 Main 55 0 8 50
Input kissface_0004 Main 73 0 8 44
Input kissface_0005 Main 66 0 12 49
Input kissface_0006 Main 52 1 12 48

```

y ahora con ICV,

```

[osotolongo@brick03 kissface]$ awk -F"," '{print
"kissface_"$2,"$3","$4","$5","$6","$7}' kissface_data.csv | sed
's/kissface_Subject/Variables/' | sed 's/kissface_\([^,]*\)//Input
kissface_\1 Main /; s/,/ /g' > kissface_body_icv.csv
[osotolongo@brick03 kissface]$ head kissface_body_icv.csv
Variables age sex years_education_fac kissing_dancing_words_fac zICV
Input kissface_0001 Main 79 1 15 50 -1.07341914119678
Input kissface_0002 Main 66 1 19 50 2.33416070384843
Input kissface_0003 Main 55 0 8 50 0.729974403694122
Input kissface_0004 Main 73 0 8 44 0.48429424611196
Input kissface_0005 Main 66 0 12 49 -0.626254790292351
Input kissface_0006 Main 52 1 12 48 2.26384943589037
Input kissface_0007 Main 70 1 23 51 1.28580372164305
Input kissface_0008 Main 73 0 15 50 -0.467965443635606
Input kissface_0009 Main 59 0 10 47 -1.0314247702616
[osotolongo@brick03 kissface]$ cat headers.txt kissface_body_icv.csv >
kissface_icv.fsgd
[osotolongo@brick03 kissface]$ head kissface_icv.fsgd
GroupDescriptorFile 1
Title FACEHBI_KD
Class Main
Variables age sex years_education_fac kissing_dancing_words_fac zICV
Input kissface_0001 Main 79 1 15 50 -1.07341914119678
Input kissface_0002 Main 66 1 19 50 2.33416070384843
Input kissface_0003 Main 55 0 8 50 0.729974403694122
Input kissface_0004 Main 73 0 8 44 0.48429424611196
Input kissface_0005 Main 66 0 12 49 -0.626254790292351
Input kissface_0006 Main 52 1 12 48 2.26384943589037

```

Ahora un momento, los *mtx*,

```

[osotolongo@brick03 kissface]$ echo "0 0 0 0 1" > noicv.mtx
[osotolongo@brick03 kissface]$ echo "0 0 0 0 1 0" > icv.mtx

```

## qcaché

OK. antes de seguir, hay que hacer el *qcaché* de los sujetos. estos se hace con

```
recon-all -s subject -qcaché
```

y hay que lanzarlo para todos los sujetos del proyecto. Generalmente esto esta hecho ya pero nos hemos inventado el proyecto y es la primera vez que hacemos el analisis.

Asi que hay que escribir algo como,

```
[osotolongo@brick03 kissface]$ mkdir slurm; for x in $(awk -F";" '{print $1}' kissface_mri.csv); do echo '#!/bin/bash' > slurm/rec_${x}.sh; echo "#SBATCH -c 2" >> slurm/rec_${x}.sh; echo "#SBATCH -o slurm/slurm_${x}_%j.out" >> slurm/rec_${x}.sh; echo "recon-all -s kissface_${x} -qcaché" >> slurm/rec_${x}.sh; chmod +x slurm/rec_${x}.sh; sbatch slurm/rec_${x}.sh; done
```

Esto lanza unos cuantos *jobs* al worload manager pero no demoran demasiado asi que da tiempo a ir escribiendo los scripts de FSGA mientras tanto.

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**Mejor opción aún es utilizar el script [pqcaché.pl](#) del pipeline que lanza este comando dentro de un proyecto.**

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## scripting fsga

y ahora los scripts para la ejecucion.

Para cortical thickness,

[fsga\\_ct.sh](#)

```
#!/bin/bash
mris_preproc --fsgd kissface_noicv.fsgd --cache-in
thickness.fwhm10.fsaverage --target fsaverage --hemi lh --out
lh.kissface.thickness.10.mgh
mris_preproc --fsgd kissface_noicv.fsgd --cache-in
thickness.fwhm10.fsaverage --target fsaverage --hemi rh --out
rh.kissface.thickness.10.mgh
mri_glmfit -y lh.kissface.thickness.10.mgh --fsgd kissface_noicv.fsgd
--C noicv.mtx --surf fsaverage lh --glmdir lh.kissface.glmdir_ct
mri_glmfit -y rh.kissface.thickness.10.mgh --fsgd kissface_noicv.fsgd
--C noicv.mtx --surf fsaverage rh --glmdir rh.kissface.glmdir_ct
mri_glmfit-sim --glmdir lh.kissface.glmdir_ct --cache 3 neg --cwp 0.05
--2spaces
```

```
mri_glmfit-sim --glmdir lh.kissface.glmdir_ct --cache 3 pos --cwp 0.05
--2spaces
mri_glmfit-sim --glmdir rh.kissface.glmdir_ct --cache 3 neg --cwp 0.05
--2spaces
mri_glmfit-sim --glmdir rh.kissface.glmdir_ct --cache 3 pos --cwp 0.05
--2spaces
```

hacemos,

```
[osotolongo@brick03 kissface]$ ./fsga_ct.sh
```

y cuando termina,

```
[osotolongo@brick03 kissface]$ for x in
*h.kissface.glmdir_ct/noicv/*.summary; do echo ${x}; grep -v "^#" ${x}; done
lh.kissface.glmdir_ct/noicv/cache.th30.neg.sig.cluster.summary
lh.kissface.glmdir_ct/noicv/cache.th30.pos.sig.cluster.summary
rh.kissface.glmdir_ct/noicv/cache.th30.neg.sig.cluster.summary
rh.kissface.glmdir_ct/noicv/cache.th30.pos.sig.cluster.summary
```

que dice que para estos parametros no hay clusters significativos.

Ahora el cortical area,


[fsga\\_sa.sh](#)

```
#!/bin/bash
mris_preproc --fsgd kissface_icv.fsgd --cache-in area.fwhm10.fsaverage
--target fsaverage --hemi lh --out lh.kissface.area.10.mgh
mris_preproc --fsgd kissface_icv.fsgd --cache-in area.fwhm10.fsaverage
--target fsaverage --hemi rh --out rh.kissface.area.10.mgh
mri_glmfit --y lh.kissface.area.10.mgh --fsgd kissface_icv.fsgd --C
icv.mtx --surf fsaverage lh --glmdir lh.kissface.glmdir_sa
mri_glmfit --y rh.kissface.area.10.mgh --fsgd kissface_icv.fsgd --C
icv.mtx --surf fsaverage rh --glmdir rh.kissface.glmdir_sa
mri_glmfit-sim --glmdir lh.kissface.glmdir_sa --cache 3 neg --cwp 0.05
--2spaces
mri_glmfit-sim --glmdir lh.kissface.glmdir_sa --cache 3 pos --cwp 0.05
--2spaces
mri_glmfit-sim --glmdir rh.kissface.glmdir_sa --cache 3 neg --cwp 0.05
--2spaces
mri_glmfit-sim --glmdir rh.kissface.glmdir_sa --cache 3 pos --cwp 0.05
--2spaces
```

lanzamos,

```
[osotolongo@brick03 kissface]$ ./fsga_sa.sh
```



 y tengo, (**fucking maths**)

```
ERROR: matrix is ill-conditioned or badly scaled, condno = 10175.5
```

**Lo que me dice que o escalo todo a z-scores o pongo los ICV en  $\$mm^3$**  🤪

que jodio, esto en R es algo como,

```
> read.csv("kissface_data.csv") -> x
> x$zAge <- (x$age - mean(x$age))/sd(x$age)
> x$zEducation <- (x$years_education_fac -
mean(x$years_education_fac))/sd(x$years_education_fac)
> x$zKD <- (x$kissing_dancing_words_fac -
mean(x$kissing_dancing_words_fac))/sd(x$kissing_dancing_words_fac)
> write.csv(x, file = "kissface_xetas_tmp.csv", row.names = FALSE)
```

y luego,

```
[osotolongo@brick03 kissface]$ head kissface_xetas_tmp.csv
"PSubject", "Subject", "age", "sex", "years_education_fac", "kissing_dancing_word
s_fac", "zICV", "zAge", "zEducation", "zKD"
"F113", 1, 79, 1, 15, 50, -1.07341914119678, 1.87955542314161, 0.0893677081683601, -0
.0152547055628048
"F115", 2, 66, 1, 19, 50, 2.33416070384843, 0.06907672568748, 1.00128309764142, -0.01
52547055628048
"F116", 3, 55, 0, 8, 50, 0.729974403694122, -1.46286678754294, -1.5064842234095, -0.0
152547055628048
"F117", 4, 73, 0, 8, 44, 0.48429424611196, 1.04394987047047, -1.5064842234095, -3.828
93109626387
"F118", 5, 66, 0, 12, 49, -0.626254790292351, 0.06907672568748, -0.594568833936437, -
0.650867437346315
"F119", 6, 52, 1, 12, 48, 2.26384943589037, -1.88066956387851, -0.594568833936437, -1
.28648016912983
"F120", 7, 70, 1, 23, 51, 1.28580372164305, 0.626147094134904, 1.91319848711449, 0.62
0358026220705
"F121", 8, 73, 0, 15, 50, -0.467965443635606, 1.04394987047047, 0.0893677081683601, -
0.0152547055628048
"F122", 9, 59, 0, 10, 47, -1.0314247702616, -0.905796419095513, -1.05052652867297, -1
.92209290091334
[osotolongo@brick03 kissface]$ sed 's/"//g;' kissface_xetas_tmp.csv | awk -
F", " '{printf("%s,%04d,%s,%s,%s,%s,%s\n", $1, $2, $8, $4, $9, $10, $7)}' | sed
's/,0000/,/Subject,/'> zkissface_data.csv
[osotolongo@brick03 kissface]$ head zkissface_data.csv
PSubject,Subject,zAge,sex,zEducation,zKD,zICV
F113,0001,1.87955542314161,1,0.0893677081683601,-0.0152547055628048,-1.07341
914119678
F115,0002,0.06907672568748,1,1.00128309764142,-0.0152547055628048,2.33416070
384843
F116,0003,-1.46286678754294,0,-1.5064842234095,-0.0152547055628048,0.7299744
```



```

03694122
F117,0004,1.04394987047047,0,-1.5064842234095,-3.82893109626387,0.4842942461
1196
F118,0005,0.06907672568748,0,-0.594568833936437,-0.650867437346315,-0.626254
790292351
F119,0006,-1.88066956387851,1,-0.594568833936437,-1.28648016912983,2.2638494
3589037
F120,0007,0.626147094134904,1,1.91319848711449,0.620358026220705,1.285803721
64305
F121,0008,1.04394987047047,0,0.0893677081683601,-0.0152547055628048,-0.46796
5443635606
F122,0009,-0.905796419095513,0,-1.05052652867297,-1.92209290091334,-1.031424
7702616
[osotolongo@brick03 kissface]$ awk -F"," '{print
"kissface_"$2,"$3","$4","$5","$6","$7}' zkissface_data.csv | sed
's/kissface_Subject/Variables/' | sed 's/kissface_\([^,]*\)\/Input
kissface_\1 Main /; s/,/ /g' > zkissface_body_icv.csv
[osotolongo@brick03 kissface]$ cat headers.txt zkissface_body_icv.csv >
kissface_icv.fsgd
[osotolongo@brick03 kissface]$ head kissface_icv.fsgd
GroupDescriptorFile 1
Title FACEHBI_KD
Class Main
Variables zAge sex zEducation zKD zICV
Input kissface_0001 Main 1.87955542314161 1 0.0893677081683601
-0.0152547055628048 -1.07341914119678
Input kissface_0002 Main 0.06907672568748 1 1.00128309764142
-0.0152547055628048 2.33416070384843
Input kissface_0003 Main -1.46286678754294 0 -1.5064842234095
-0.0152547055628048 0.729974403694122
Input kissface_0004 Main 1.04394987047047 0 -1.5064842234095
-3.82893109626387 0.48429424611196
Input kissface_0005 Main 0.06907672568748 0 -0.594568833936437
-0.650867437346315 -0.626254790292351
Input kissface_0006 Main -1.88066956387851 1 -0.594568833936437
-1.28648016912983 2.2638494358903

```

**and rerun!!!!**

but same shit,

```

[osotolongo@brick03 kissface]$ for x in *h.kissface.glmdir_sa/icv/*.summary;
do echo ${x}; grep -v "^#" ${x}; done
lh.kissface.glmdir_sa/icv/cache.th30.neg.sig.cluster.summary
lh.kissface.glmdir_sa/icv/cache.th30.pos.sig.cluster.summary
rh.kissface.glmdir_sa/icv/cache.th30.neg.sig.cluster.summary
rh.kissface.glmdir_sa/icv/cache.th30.pos.sig.cluster.summary

```

a ver que pasa con el volumen, (**Nota:** Como cambie la DB para *surface area* al volumen no hay que

hacerle nada porque usa la misma)

## fsga\_v.sh

```
#!/bin/bash
mris_preproc --fsgd kissface_icv.fsgd --cache-in
volume.fwhm10.fsaverage --target fsaverage --hemi lh --out
lh.kissface.volume.10.mgh
mris_preproc --fsgd kissface_icv.fsgd --cache-in
volume.fwhm10.fsaverage --target fsaverage --hemi rh --out
rh.kissface.volume.10.mgh
mri_glmfit --y lh.kissface.volume.10.mgh --fsgd kissface_icv.fsgd --C
icv.mtx --surf fsaverage lh --glmdir lh.kissface.glmdir_v
mri_glmfit --y rh.kissface.volume.10.mgh --fsgd kissface_icv.fsgd --C
icv.mtx --surf fsaverage rh --glmdir rh.kissface.glmdir_v
mri_glmfit-sim --glmdir lh.kissface.glmdir_v --cache 3 neg --cwp 0.05 -
-2spaces
mri_glmfit-sim --glmdir lh.kissface.glmdir_v --cache 3 pos --cwp 0.05 -
-2spaces
mri_glmfit-sim --glmdir rh.kissface.glmdir_v --cache 3 neg --cwp 0.05 -
-2spaces
mri_glmfit-sim --glmdir rh.kissface.glmdir_v --cache 3 pos --cwp 0.05 -
-2spaces
```

```
[osotolongo@brick03 kissface]$ ./fsga_v.sh
[osotolongo@brick03 kissface]$ for x in *h.kissface.glmdir_v/icv/*.summary;
do echo ${x}; grep -v "^#" ${x}; done
lh.kissface.glmdir_v/icv/cache.th30.neg.sig.cluster.summary
lh.kissface.glmdir_v/icv/cache.th30.pos.sig.cluster.summary
rh.kissface.glmdir_v/icv/cache.th30.neg.sig.cluster.summary
rh.kissface.glmdir_v/icv/cache.th30.pos.sig.cluster.summary
```



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