Problemas con el procesamiento de FBB y como no morir en el intento

bulk conversion

Voy a escribir un procedimiento nuevo para la conversion de DCM a NIfTI aprovechando que tengo nuevos procedimientos y software para todo.

Primero,

```
[osotolongo@detritus facehbi]$ ls /nas/clinic/facehbi
FACEHBI-F001B  FACEHBI-F018B  FACEHBI-F036B  FACEHBI-F055B  FACEHBI-F072B
FACEHBI-F088B  FACEHBI-F105B  FACEHBI-F122B  FACEHBI-F139B  FACEHBI-F155B
FACEHBI-F171B  FACEHBI-F191B  FACEHBI-F208B
FACEHBI-F002B  FACEHBI-F019B  FACEHBI-F037B  FACEHBI-F056B  FACEHBI-F073B
FACEHBI-F089B  FACEHBI-F106B  FACEHBI-F123B  FACEHBI-F140B  FACEHBI-F156B
FACEHBI-F173B  FACEHBI-F192B  FACEHBI-F209B
FACEHBI-F003B  FACEHBI-F020B  FACEHBI-F038B  FACEHBI-F057B  FACEHBI-F074B
FACEHBI-F090B  FACEHBI-F107B  FACEHBI-F124B  FACEHBI-F141B  FACEHBI-F157B
FACEHBI-F174B  FACEHBI-F193B  FACEHBI-F210B
FACEHBI-F004B  FACEHBI-F021B  FACEHBI-F039B  FACEHBI-F058B  FACEHBI-F075B
FACEHBI-F091B  FACEHBI-F108B  FACEHBI-F125B  FACEHBI-F142B  FACEHBI-F158B
FACEHBI-F175B  FACEHBI-F194B  FACEHBI-F211B
FACEHBI-F005B  FACEHBI-F022B  FACEHBI-F040B  FACEHBI-F059B  FACEHBI-F076B
FACEHBI-F092B  FACEHBI-F109B  FACEHBI-F126B  FACEHBI-F143B  FACEHBI-F159B
FACEHBI-F177B  FACEHBI-F195B  FACEHBI-F212B
FACEHBI-F006B  FACEHBI-F023B  FACEHBI-F041B  FACEHBI-F060B  FACEHBI-F077B
FACEHBI-F093B  FACEHBI-F110B  FACEHBI-F127B  FACEHBI-F144B  FACEHBI-F160B
FACEHBI-F178B  FACEHBI-F196B  FACEHBI-F213B
FACEHBI-F007B  FACEHBI-F024B  FACEHBI-F042B  FACEHBI-F061B  FACEHBI-F078B
FACEHBI-F094B  FACEHBI-F111B  FACEHBI-F128B  FACEHBI-F145B  FACEHBI-F161B
FACEHBI-F179B  FACEHBI-F197B  FACEHBI-F214B
FACEHBI-F008B  FACEHBI-F025B  FACEHBI-F043B  FACEHBI-F062B  FACEHBI-F079B
FACEHBI-F095B  FACEHBI-F112B  FACEHBI-F129B  FACEHBI-F146B  FACEHBI-F162B
FACEHBI-F181B  FACEHBI-F198B  FACEHBI-F215B
FACEHBI-F009B  FACEHBI-F026B  FACEHBI-F044B  FACEHBI-F063B  FACEHBI-F080B
FACEHBI-F096B  FACEHBI-F113B  FACEHBI-F130B  FACEHBI-F147B  FACEHBI-F163B
FACEHBI-F182B  FACEHBI-F199B
FACEHBI-F010B  FACEHBI-F027B  FACEHBI-F047B  FACEHBI-F064B  FACEHBI-F081B
FACEHBI-F097B  FACEHBI-F115B  FACEHBI-F131B  FACEHBI-F148B  FACEHBI-F164B
FACEHBI-F183B  FACEHBI-F200B
FACEHBI-F011B  FACEHBI-F028B  FACEHBI-F048B  FACEHBI-F065B  FACEHBI-F082B
FACEHBI-F098B  FACEHBI-F116B  FACEHBI-F132B  FACEHBI-F149B  FACEHBI-F165B
FACEHBI-F184B  FACEHBI-F201B
FACEHBI-F012B  FACEHBI-F029B  FACEHBI-F049B  FACEHBI-F066B  FACEHBI-F083B
FACEHBI-F099B  FACEHBI-F117B  FACEHBI-F133B  FACEHBI-F150B  FACEHBI-F166B
FACEHBI-F185B  FACEHBI-F202B
FACEHBI-F013B  FACEHBI-F030B  FACEHBI-F050B  FACEHBI-F068B  FACEHBI-F084B
```

```
FACEHBI-F101B  FACEHBI-F118B  FACEHBI-F134B  FACEHBI-F151B  FACEHBI-F167B
FACEHBI-F186B  FACEHBI-F203B
FACEHBI-F014B  FACEHBI-F031B  FACEHBI-F052B  FACEHBI-F069B  FACEHBI-F085B
FACEHBI-F102B  FACEHBI-F119B  FACEHBI-F135B  FACEHBI-F152B  FACEHBI-F168B
FACEHBI-F188B  FACEHBI-F204B
FACEHBI-F015B  FACEHBI-F033B  FACEHBI-F053B  FACEHBI-F070B  FACEHBI-F086B
FACEHBI-F103B  FACEHBI-F120B  FACEHBI-F136B  FACEHBI-F153B  FACEHBI-F169B
FACEHBI-F189B  FACEHBI-F205B
FACEHBI-F017B  FACEHBI-F035B  FACEHBI-F054B  FACEHBI-F071B  FACEHBI-F087B
FACEHBI-F104B  FACEHBI-F121B  FACEHBI-F137B  FACEHBI-F154B  FACEHBI-F170B
FACEHBI-F190B  FACEHBI-F207B
[osotolongo@detritus facehbi]$ dcm2niix -o tmp -z y
/nas/clinic/facehbi/FACEHBI-F001B/DICOM/
Chris Rorden's dcm2niiX version v1.0.20180622 (JP2:OpenJPEG) (JP-LS:CharLS)
GCC5.5.0 (64-bit Linux)
Found 620 DICOM file(s)
Convert 109 DICOM as tmp/DICOM_FACEHBI_Florbetaben_20min_20141211120511_5
(400x400x109x1)
compress: "/usr/local/mricron/pigz_mricron" -n -f -6
"tmp/DICOM_FACEHBI_Florbetaben_20min_20141211120511_5.nii"
Convert 75 DICOM as tmp/DICOM_FACEHBI_20141211120511_3 (512x512x75x1)
compress: "/usr/local/mricron/pigz_mricron" -n -f -6
"tmp/DICOM_FACEHBI_20141211120511_3.nii"
Convert 436 DICOM as tmp/DICOM_FACEHBI_Florbetaben_4x5min_20141211120511_4
(400x400x109x4)
compress: "/usr/local/mricron/pigz_mricron" -n -f -6
"tmp/DICOM_FACEHBI_Florbetaben_4x5min_20141211120511_4.nii"
Conversion required 105.374635 seconds (6.340000 for core code).
[osotolongo@detritus facehbi]$ ls tmp
DICOM_FACEHBI_20141211120511_3.json
DICOM_FACEHBI_Florbetaben_20min_20141211120511_5.json
DICOM_FACEHBI_Florbetaben_4x5min_20141211120511_4.json
DICOM_FACEHBI_20141211120511_3.nii.gz
DICOM_FACEHBI_Florbetaben_20min_20141211120511_5.nii.gz
DICOM_FACEHBI_Florbetaben_4x5min_20141211120511_4.nii.gz
[osotolongo@detritus facehbi]$ for x in tmp/*.nii.gz; do fslinfo ${x}; done
data_type      INT16
dim1           512
dim2           512
dim3           75
dim4           1
datatype       4
pixdim1        0.585938
pixdim2        0.585938
pixdim3        3.000000
pixdim4        0.000000
cal_max        0.0000
cal_min        0.0000
file_type      NIFTI-1+
filename       tmp/DICOM_FACEHBI_Florbetaben_20min_20141211120511_5.nii.gz
data_type      FLOAT32
```

```
dim1            400
dim2            400
dim3            109
dim4            1
datatype        16
pixdim1         1.018210
pixdim2         1.018210
pixdim3         2.027008
pixdim4         0.000000
cal_max         0.0000
cal_min         0.0000
file_type       NIFTI-1+
filename        tmp/DICOM_FACEHBI_Florbetaben_4x5min_20141211120511_4.nii.gz
data_type       FLOAT32
dim1            400
dim2            400
dim3            109
dim4            4
datatype        16
pixdim1         1.018210
pixdim2         1.018210
pixdim3         2.027008
pixdim4         1.000000
cal_max         0.0000
cal_min         0.0000
file_type       NIFTI-1+
```

y me hago un scriptcillo para convertir los DCM, escoger el adecuado usando *fslinfo* y hacer un *fslsplit* en el directorio final,

update_fbb.pl

```
#!/usr/bin/perl

use strict;
use warnings;
use NEURO qw(load_study);
use Data::Dump qw(dump);
use File::Find::Rule;

my $study = "facehbi";
my %std = load_study($study);
my $src_dir = "/nas/clinic/facehbi";
my $output_dir = $std{'PET-FBB'};
my @other_exts = ("nii.gz","json");

opendir(my $dh, $src_dir) || die "Can't opendir $src_dir: $!";
my @adqs = grep {/^[A-Za-z]/} readdir($dh);
closedir $dh;

foreach my $adq (sort @adqs) {
```

```
    (my $subject = $adq) =~ s/.*-F(.*)B$/0$1/;
    my $order = 'dcm2niix -z y -o '.$std{'DATA'}.'/tmp/
'.$src_dir.'/'.$adq.'/DICOM';
    print "$order\n";
    system($order);
    my @conv_files = find(file => 'name' => "*.nii.gz", in =>
$std{'DATA'}.'/tmp/');
    foreach my $nii_file (@conv_files){
        $order = 'fslinfo '.$nii_file;
        my %xinfo;
        foreach (qx/$order/){
            my ( $key, $value ) = /(\S+)\s+(\S+)\s*.*/;
            $xinfo{$key} =$value;
        }
        if($xinfo{"dim4"}>1){
            print "Choosing and moving files\n";
            $order = 'fslsplit '.$nii_file.'
'.$output_dir.'/smc'.$subject.'s -t';
            print "$order\n";
            system($order);
        }
    }
    print "Cleaning house\n";
    $order = "rm $std{'DATA'}/tmp/*";
    system($order);
}
```

Lo lanzo desde el directorio del proyecto,

```
[osotolongo@detritus facehbi]$ ./update_fbb.pl
```

y ya esta, los fbb me quedan ordenados correctamente.

de DICOM a NiFTI

Delete!

Necesitamos convertir los DICOM de FBB a formato NiFTI-1 para trabajar con FSL. El servidor DICOM corta el numero de slices por directorio a 500 por lo que inicialmente hubo muchisimos problemas de conversion y procesamiento.

Luego hay que buscar por todas las subcarpetas del DICOM las imagenes 4x5min que estan desordenadas. Para convertir uno de los sujetos ha de hacerse algo asi,

```
$ for x in `find /nas/raw_images/facehbi/fbb/FACEHBI-F001B/DICOM/ -type f`;
do if [[ `dckey -k "SeriesDescription" $x 2>&1 | grep  "4x5min"` ]]; then cp
$x /nas/facehbi/tmp_2nifti/; fi; done; y=$(ls /nas/facehbi/tmp_2nifti/ |
head -n 1); dcm2nii -o /nas/facehbi/tmp/ /nas/facehbi/tmp_2nifti/$y;
```

que da una salida muy ruidosa, pero funciona. Para hacerlos todos de una tacada habria que iterar esto por todos los sujetos.

```
for s in `ls -d /nas/clinic/* | grep FACEHBI | grep "B$"`; do sbj=$(echo $s
|sed 's/.*-F\(.*\)B$/\1/');  for x in `find ${s}/DICOM/ -type f`; do if [[
`dckey -k "SeriesDescription" $x 2>&1 | grep  "4x5min"` ]]; then cp $x
/nas/facehbi/tmp_2nifti/; fi; done; y=$(ls /nas/facehbi/tmp_2nifti/ | head -
n 1); dcm2nii -o /nas/facehbi/tmp/ /nas/facehbi/tmp_2nifti/$y; conv=$(ls
/nas/facehbi/tmp/ | head -n 1); fslsplit /nas/facehbi/tmp/${conv}
/nas/facehbi/fbb_first/smc0${sbj}s -t; rm -rf /nas/facehbi/tmp/*; rm -rf
/nas/facehbi/tmp_2nifti/*; done
```

si queremos aprovechar un archivo *yet.txt* (ver aqui)

```
$ for sbj in `awk -F";" '{print $1}' yet.txt | sed 's/0//;'`; do
s="/nas/clinic/FACEHBI-F${sbj}B";  for x in `find ${s}/DICOM/ -type f`; do
if [[ `dckey -k "SeriesDescription" $x 2>&1 | grep  "4x5min"` ]]; then cp $x
/nas/facehbi/tmp_2nifti/; fi; done; y=$(ls /nas/facehbi/tmp_2nifti/ | head -
n 1); dcm2nii -o /nas/facehbi/tmp/ /nas/facehbi/tmp_2nifti/$y; conv=$(ls
/nas/facehbi/tmp/ | head -n 1); fslsplit /nas/facehbi/tmp/${conv}
/nas/facehbi/fbb/smc0${sbj}s -t; rm -rf /nas/facehbi/tmp/*; rm -rf
/nas/facehbi/tmp_2nifti/*; done
```

Correccion de movimiento

Ahora tenemos 4 archivos representando la integracion de 5 min y hay que corregistrarlos al espacio de usuario. Lo primero es traer el archivo de freesurfer y luego corregistrar cada uo de los fbb al user space. despues se ha de unirlos temporalmente y hacer un mcflirt.

lo primero seria traerse la mri del directorio de freesurfer

get_fs_subj

get_fs_subj.sh

```
#!/bin/sh
study=$1
shift

id=$1
shift

dir=$1
shift

debug=0

#First get the freesurfer processed MRIs
${FREESURFER_HOME}/bin/mri_vol2vol --mov
```

```
${SUBJECTS_DIR}/${study}_${id}/mri/nu.mgz --targ
${SUBJECTS_DIR}/${study}_${id}/mri/rawavg.mgz --regheader --o
${dir}/${id}_tmp_nu_in_rawavg.mgz
${FREESURFER_HOME}/bin/mri_convert --in_type mgz --out_type nii
${dir}/${id}_tmp_nu_in_rawavg.mgz ${dir}/${id}_tmp.nii.gz
${FSLDIR}/bin/fslreorient2std ${dir}/${id}_tmp ${dir}/${id}_struc
${FREESURFER_HOME}/bin/mri_vol2vol --mov
${SUBJECTS_DIR}/${study}_${id}/mri/brain.mgz --targ
${SUBJECTS_DIR}/${study}_${id}/mri/rawavg.mgz --regheader --o
${dir}/${id}_tmp_brain_in_rawavg.mgz
${FREESURFER_HOME}/bin/mri_convert --in_type mgz --out_type nii
${dir}/${id}_tmp_brain_in_rawavg.mgz ${dir}/${id}_tmp_brain.nii.gz
${FSLDIR}/bin/fslreorient2std ${dir}/${id}_tmp_brain ${dir}/${id}_brain

if [ $debug = 0 ] ; then
    rm ${dir}/${id}_tmp*
fi
```

y luego corregistrar cada imagen al espacio del sujeto. Hay 4 variantes para esto.

1.- Intentando registrar cada imagen independientemente.

fbb_reg

fbbtemp_reg.sh

```
#!/bin/sh

study=$1
shift

id=$1
shift

tdir=$1
shift

wdir=$1
shift

debug=1

#get the uncorrected PETs and register to user space MRI
for i in {0..3}; do
        tf=`printf "${id}s%04d" $i`
        ${FSLDIR}/bin/imcp ${tdir}/${tf} ${tdir}/${id}_tmp
        ${FSLDIR}/bin/flirt -ref ${wdir}/${id}_struc -in
${tdir}/${id}_tmp -omat ${tdir}/${tf}_pet2struc.mat -out
```

```
${tdir}/${tf}_reg
done
a=`for i in {0..3}; do printf " ${tdir}/${id}s%04d_reg " $i; done`
${FSLDIR}/bin/fslmerge -t ${wdir}/${id}_tmp_mvc $a
${FSLDIR}/bin/mcflirt -in ${wdir}/${id}_tmp_mvc -out
${wdir}/${id}_tmp_corr
${PIPEDIR}/bin/4dmean.pl ${wdir}/${id}_tmp_corr
${FSLDIR}/bin/flirt -ref ${wdir}/${id}_struc -in ${wdir}/${id}_mean -
omat ${wdir}/${id}_fbb2struc.mat -out ${wdir}/${id}_fbb

if [ $debug = 0 ] ; then
    rm ${tdir}/${id}_tmp*
    rm ${wdir}/${id}_tmp*
fi
```

2.- Usando la informacion de un registro para el resto (-useg)

fbb_regc

fbbtemp_regc.sh

```
#!/bin/sh

study=$1
shift

id=$1
shift

tdir=$1
shift

wdir=$1
shift

sok=$1
shift

debug=1

#Now get the uncorrected PETs and register to user space MRI
bsc=`printf "${id}s%04d" $sok`
${FSLDIR}/bin/imcp ${tdir}/${bsc} ${tdir}/${id}_tmp
${FSLDIR}/bin/flirt -ref ${wdir}/${id}_struc -in ${tdir}/${id}_tmp -
omat ${tdir}/${bsc}_pet2struc.mat -out ${tdir}/${bsc}_reg
for i in {0..3}; do
        if [ "$i" != "$sok" ]; then
                tf=`printf "${id}s%04d" $i`
```

```
                ${FSLDIR}/bin/imcp ${tdir}/${tf} ${tdir}/${id}_tmp
                ${FSLDIR}/bin/flirt -ref ${wdir}/${id}_struc -in
${tdir}/${id}_tmp -init ${tdir}/${bsc}_pet2struc.mat -omat
${tdir}/${tf}_pet2struc.mat -out ${tdir}/${tf}_reg
        fi
done
a=`for i in {0..3}; do printf " ${tdir}/${id}s%04d_reg " $i; done`
${FSLDIR}/bin/fslmerge -t ${wdir}/${id}_tmp_mvc $a
${FSLDIR}/bin/mcflirt -in ${wdir}/${id}_tmp_mvc -out
${wdir}/${id}_tmp_corr
${PIPEDIR}/bin/4dmean.pl ${wdir}/${id}_tmp_corr
${FSLDIR}/bin/flirt -ref ${wdir}/${id}_struc -in ${wdir}/${id}_mean -
omat ${wdir}/${id}_fbb2struc.mat -out ${wdir}/${id}_fbb

if [ $debug = 0 ] ; then
    rm ${tdir}/${id}_tmp*
    rm ${wdir}/${id}_tmp*
fi
```

3.- Usando la informacion solo del cerebro extraido para hacer el corregistro (-useb)

fbb_regb

fbbtemp_regb.sh

```
#!/bin/sh

study=$1
shift

id=$1
shift

tdir=$1
shift

wdir=$1
shift

sok=$1
shift

debug=1

#Now get the uncorrected PETs and register to user space MRI
bsc=`printf "${id}s%04d" $sok`
${FSLDIR}/bin/imcp ${tdir}/${bsc} ${tdir}/${id}_tmp
${FSLDIR}/bin/flirt -ref ${wdir}/${id}_brain -in ${tdir}/${id}_tmp -
```

```
omat ${tdir}/${bsc}_pet2struc.mat -out ${tdir}/${bsc}_reg
for i in {0..3}; do
        if [ "$i" != "$sok" ]; then
                tf=`printf "${id}s%04d" $i`
                ${FSLDIR}/bin/imcp ${tdir}/${tf} ${tdir}/${id}_tmp
                ${FSLDIR}/bin/flirt -ref ${wdir}/${id}_brain -in
${tdir}/${id}_tmp -init ${tdir}/${bsc}_pet2struc.mat -omat
${tdir}/${tf}_pet2struc.mat -out ${tdir}/${tf}_reg
        fi
done
a=`for i in {0..3}; do printf " ${tdir}/${id}s%04d_reg " $i; done`
${FSLDIR}/bin/fslmerge -t ${wdir}/${id}_tmp_mvc $a
${FSLDIR}/bin/mcflirt -in ${wdir}/${id}_tmp_mvc -out
${wdir}/${id}_tmp_corr
${PIPEDIR}/bin/4dmean.pl ${wdir}/${id}_tmp_corr
${FSLDIR}/bin/flirt -ref ${wdir}/${id}_struc -in ${wdir}/${id}_mean -
omat ${wdir}/${id}_fbb2struc.mat -out ${wdir}/${id}_fbb

if [ $debug = 0 ] ; then
    rm ${tdir}/${id}_tmp*
    rm ${wdir}/${id}_tmp*
fi
```

4.- el mas complicado, usando una mascara. Este metodo se probo con el corregistro de PiBs y usa un umbral de intensidad (-usem)

fbb_regm

fbbtemp_regm.sh

```
#!/bin/sh

study=$1
shift

id=$1
shift

tdir=$1
shift

wdir=$1
shift

#sok=$1
#shift

treshold=$1
```

```
shift

debug=1

#Now get the uncorrected PETs and register to user space MRI
bsc=`printf "${id}s%04d" $sok`
${FSLDIR}/bin/fslreorient2std ${tdir}/${bsc} ${tdir}/${bsc}_tmp
if [ $treshold = 0 ] ; then
        ${FSLDIR}/bin/fslmaths ${tdir}/${bsc}_tmp -thr ${treshold} -bin
${tdir}/${bsc}_tmp_fbb_mask
else
        ${FSLDIR}/bin/fslmaths ${tdir}/${bsc}_tmp -thrP ${treshold} -
bin ${tdir}/${bsc}_tmp_fbb_mask
fi
${FSLDIR}/bin/flirt -ref ${wdir}/${id}_struc -in
${tdir}/${bsc}_tmp_fbb_mask -omat ${tdir}/${bsc}_tmp_fbb -dof 9
${FSLDIR}/bin/flirt -ref ${wdir}/${id}_struc -in ${tdir}/${bsc} -
applyxfm -init ${tdir}/${bsc}_tmp_fbb -out ${tdir}/${bsc}_reg -omat
${tdir}/${bsc}_pet2struc.mat

for i in {0..3}; do
        if [ "$i" != "$sok" ]; then
                tf=`printf "${id}s%04d" $i`
                ${FSLDIR}/bin/fslreorient2std ${tdir}/${tf}
${tdir}/${id}_tmp
                if [ $treshold = 0 ] ; then
                        ${FSLDIR}/bin/fslmaths ${tdir}/${id}_tmp -thr
${treshold} -bin ${tdir}/${tf}_tmp_fbb_mask
                else
                        ${FSLDIR}/bin/fslmaths ${tdir}/${id}_tmp -thrP
${treshold} -bin ${tdir}/${tf}_tmp_fbb_mask
                fi
                ${FSLDIR}/bin/flirt -ref ${wdir}/${id}_struc -in
${tdir}/${tf}_tmp_fbb_mask -omat ${tdir}/${tf}_tmp_fbb -init
${tdir}/${bsc}_pet2struc.mat -dof 9
                ${FSLDIR}/bin/flirt -ref ${wdir}/${id}_struc -in
${tdir}/${tf} -applyxfm -init ${tdir}/${tf}_tmp_fbb -out
${tdir}/${tf}_reg
        fi
done
a=`for i in {0..3}; do printf " ${tdir}/${id}s%04d_reg " $i; done`
${FSLDIR}/bin/fslmerge -t ${wdir}/${id}_tmp_mvc $a
${FSLDIR}/bin/mcflirt -in ${wdir}/${id}_tmp_mvc -out
${wdir}/${id}_tmp_corr
${PIPEDIR}/bin/4dmean.pl ${wdir}/${id}_tmp_corr
${FSLDIR}/bin/flirt -ref ${wdir}/${id}_struc -in ${wdir}/${id}_mean -
omat ${wdir}/${id}_fbb2struc.mat -out ${wdir}/${id}_fbb

if [ $debug = 0 ] ; then
    rm ${tdir}/${id}_tmp*
    rm ${wdir}/${id}_tmp*
```

```
fi
```

Esto lo he intentado agrupar en el script *fbb_correct.pl*,

fbb_correct.pl (chunk)

```
my $study;
my $cfile;
my $wbrain = 0;
my $wguide = 0;
my $wmask = 0;
my $sok = 0;

@ARGV = ("-h") unless @ARGV;
while (@ARGV and $ARGV[0] =~ /^-/) {
    $_ = shift;
    last if /^--$/;
    if (/^-e/) { $study = shift; chomp($study);}
    if (/^-cut/) { $cfile = shift; chomp($cfile);}
    if (/^-useg/) { $sok = shift; $wguide = 1;}
    if (/^-useb/) { $sok = shift; $wbrain = 1;}
    if (/^-usem/) { $sok = shift; $wmask = 1;}
    if (/^-h/) { print_help $ENV{'PIPEDIR'}.'/doc/fbb_reg.hlp'; exit;}
}
```

y despues,

```
foreach my $subject (@ok_pets){
        $pm->start and next;
        my $order;
        if($wmask){
                $order = "fbbtemp_regm.sh ".$study."
".$pets{$subject}.$subject." ".$petnc_dir." ".$w_dir." ".$sok;
        }elsif($wguide){
                $order = "fbbtemp_regc.sh ".$study."
".$pets{$subject}.$subject." ".$petnc_dir." ".$w_dir." ".$sok;
        }elsif($wbrain){
                $order = "fbbtemp_regb.sh ".$study."
".$pets{$subject}.$subject." ".$petnc_dir." ".$w_dir." ".$sok;
        }else{
                $order = "fbbtemp_reg.sh ".$study."
".$pets{$subject}.$subject." ".$petnc_dir." ".$w_dir;
        }
        print "$order\n";
        system($order);
        $pm->finish;
}
$pm->wait_all_children;
```

Resumiendo

si todo va bien basta con hacer:

```
$ fbb_correct.pl -e facehbi
$ parallel_fbb_rois_metrics.pl facehbi
```

Postprocessing (carrot)

```
$ cd /home/osotolongo/Documents/ACE/facehbi
$ R CMD BATCH selected_mri.r
$ sed 's/"//g' facehbi_mri_selected.csv | awk -F"," '{if($1!="Subject")
printf("%04d;%s;%s;%s;%s;%s;%s\n",$1,$2,$3,$4,$5,$6,$7); else
printf("%s;%s;%s;%s;%s;%s;%s\n",$1,$2,$3,$4,$5,$6,$7)}' >
facehbi_mri_selected_reformatted.csv
$ join -t";" -j 1 facehbi_fbb_fs_suvr_predef.csv
facehbi_mri_selected_reformatted.csv > facehbi_fbb_mri.csv
$ join -t";" -j 1 facehbi_fbb_mri.csv facehbi_dti.csv >
facehbi_fbb_mri_dti.csv
$ awk 'NR<2{print $0;next}{print $0| "sort -k1"}' demographics.csv | sed
's/, /;/g' > facehbi_demographics.csv
$ join -t";" -j 1 facehbi_demographics.csv facehbi_fbb_mri_dti.csv >
facehbi_data.csv
$ sed 's/;/ /g' facehbi_data.csv > facehbi_data.dat
```

Note this: *extract_data | awk 'NR<3{print $0;next}{print $0| "sort -r"}'* 😉

```
$ head -n 1 facehbi_data.csv | sed 's/;/\n/g' | cat -n
     1  Subject
     2  Gender
     3  Education
     4  Age
     5  FBB
     6  HV
     7  aHV
     8  CMT
     9  aCMT
    10  WMH
    11  nWMH
    12  Unclassified_FA_Mean
    13  Unclassified_FA_STD
    14  Unclassified_MD_Mean
    15  Unclassified_MD_STD
    16  Middle cerebellar peduncle_FA_Mean
    17  Middle cerebellar peduncle_FA_STD
    18  Middle cerebellar peduncle_MD_Mean
    19  Middle cerebellar peduncle_MD_STD
    20  Medial lemniscus L_FA_Mean
```

```
Medial lemniscus L_FA_STD
Medial lemniscus L_MD_Mean
Medial lemniscus L_MD_STD
Inferior cerebellar peduncle R  _FA_Mean
Inferior cerebellar peduncle R  _FA_STD
Inferior cerebellar peduncle R  _MD_Mean
Inferior cerebellar peduncle R  _MD_STD
Inferior cerebellar peduncle L_FA_Mean
Inferior cerebellar peduncle L_FA_STD
Inferior cerebellar peduncle L_MD_Mean
Inferior cerebellar peduncle L_MD_STD
Superior cerebellar peduncle R_FA_Mean
Superior cerebellar peduncle R_FA_STD
Superior cerebellar peduncle R_MD_Mean
Superior cerebellar peduncle R_MD_STD
Superior cerebellar peduncle L_FA_Mean
Superior cerebellar peduncle L_FA_STD
Superior cerebellar peduncle L_MD_Mean
Superior cerebellar peduncle L_MD_STD
Cerebral peduncle R_FA_Mean
Cerebral peduncle R_FA_STD
Cerebral peduncle R_MD_Mean
Cerebral peduncle R_MD_STD
Cerebral peduncle L_FA_Mean
Cerebral peduncle L_FA_STD
Cerebral peduncle L_MD_Mean
Cerebral peduncle L_MD_STD
Anterior limb of internal capsule R_FA_Mean
Anterior limb of internal capsule R_FA_STD
Anterior limb of internal capsule R_MD_Mean
Anterior limb of internal capsule R_MD_STD
Anterior limb of internal capsule L_FA_Mean
Anterior limb of internal capsule L_FA_STD
Anterior limb of internal capsule L_MD_Mean
Anterior limb of internal capsule L_MD_STD
Posterior limb of internal capsule R_FA_Mean
Posterior limb of internal capsule R_FA_STD
Posterior limb of internal capsule R_MD_Mean
Posterior limb of internal capsule R_MD_STD
Pontine crossing tract (a part of MCP)_FA_Mean
Pontine crossing tract (a part of MCP)_FA_STD
Pontine crossing tract (a part of MCP)_MD_Mean
Pontine crossing tract (a part of MCP)_MD_STD
Posterior limb of internal capsule L_FA_Mean
Posterior limb of internal capsule L_FA_STD
Posterior limb of internal capsule L_MD_Mean
Posterior limb of internal capsule L_MD_STD
Retrolenticular part of internal capsule R_FA_Mean
Retrolenticular part of internal capsule R_FA_STD
Retrolenticular part of internal capsule R_MD_Mean
Retrolenticular part of internal capsule R_MD_STD
```

```
    72  Retrolenticular part of internal capsule L_FA_Mean
    73  Retrolenticular part of internal capsule L_FA_STD
    74  Retrolenticular part of internal capsule L_MD_Mean
    75  Retrolenticular part of internal capsule L_MD_STD
    76  Anterior corona radiata R_FA_Mean
    77  Anterior corona radiata R_FA_STD
    78  Anterior corona radiata R_MD_Mean
    79  Anterior corona radiata R_MD_STD
    80  Anterior corona radiata L_FA_Mean
    81  Anterior corona radiata L_FA_STD
    82  Anterior corona radiata L_MD_Mean
    83  Anterior corona radiata L_MD_STD
    84  Superior corona radiata R_FA_Mean
    85  Superior corona radiata R_FA_STD
    86  Superior corona radiata R_MD_Mean
    87  Superior corona radiata R_MD_STD
    88  Superior corona radiata L_FA_Mean
    89  Superior corona radiata L_FA_STD
    90  Superior corona radiata L_MD_Mean
    91  Superior corona radiata L_MD_STD
    92  Posterior corona radiata R_FA_Mean
    93  Posterior corona radiata R_FA_STD
    94  Posterior corona radiata R_MD_Mean
    95  Posterior corona radiata R_MD_STD
    96  Posterior corona radiata L_FA_Mean
    97  Posterior corona radiata L_FA_STD
    98  Posterior corona radiata L_MD_Mean
    99  Posterior corona radiata L_MD_STD
   100  Posterior thalamic radiation (include optic radiation) R_FA_Mean
   101  Posterior thalamic radiation (include optic radiation) R_FA_STD
   102  Posterior thalamic radiation (include optic radiation) R_MD_Mean
   103  Posterior thalamic radiation (include optic radiation) R_MD_STD
   104  Genu of corpus callosum_FA_Mean
   105  Genu of corpus callosum_FA_STD
   106  Genu of corpus callosum_MD_Mean
   107  Genu of corpus callosum_MD_STD
   108  Posterior thalamic radiation (include optic radiation) L_FA_Mean
   109  Posterior thalamic radiation (include optic radiation) L_FA_STD
   110  Posterior thalamic radiation (include optic radiation) L_MD_Mean
   111  Posterior thalamic radiation (include optic radiation) L_MD_STD
   112  Sagittal stratum (include inferior longitidinal fasciculus and
inferior fronto-occipital fasciculus) R_FA_Mean
   113  Sagittal stratum (include inferior longitidinal fasciculus and
inferior fronto-occipital fasciculus) R_FA_STD
   114  Sagittal stratum (include inferior longitidinal fasciculus and
inferior fronto-occipital fasciculus) R_MD_Mean
   115  Sagittal stratum (include inferior longitidinal fasciculus and
inferior fronto-occipital fasciculus) R_MD_STD
   116  Sagittal stratum (include inferior longitidinal fasciculus and
inferior fronto-occipital fasciculus) L_FA_Mean
   117  Sagittal stratum (include inferior longitidinal fasciculus and
```

```
inferior fronto-occipital fasciculus) L_FA_STD
   118  Sagittal stratum (include inferior longitidinal fasciculus and
inferior fronto-occipital fasciculus) L_MD_Mean
   119  Sagittal stratum (include inferior longitidinal fasciculus and
inferior fronto-occipital fasciculus) L_MD_STD
   120  External capsule R_FA_Mean
   121  External capsule R_FA_STD
   122  External capsule R_MD_Mean
   123  External capsule R_MD_STD
   124  External capsule L_FA_Mean
   125  External capsule L_FA_STD
   126  External capsule L_MD_Mean
   127  External capsule L_MD_STD
   128  Cingulum (cingulate gyrus) R_FA_Mean
   129  Cingulum (cingulate gyrus) R_FA_STD
   130  Cingulum (cingulate gyrus) R_MD_Mean
   131  Cingulum (cingulate gyrus) R_MD_STD
   132  Cingulum (cingulate gyrus) L_FA_Mean
   133  Cingulum (cingulate gyrus) L_FA_STD
   134  Cingulum (cingulate gyrus) L_MD_Mean
   135  Cingulum (cingulate gyrus) L_MD_STD
   136  Cingulum (hippocampus) R_FA_Mean
   137  Cingulum (hippocampus) R_FA_STD
   138  Cingulum (hippocampus) R_MD_Mean
   139  Cingulum (hippocampus) R_MD_STD
   140  Cingulum (hippocampus) L_FA_Mean
   141  Cingulum (hippocampus) L_FA_STD
   142  Cingulum (hippocampus) L_MD_Mean
   143  Cingulum (hippocampus) L_MD_STD
   144  Fornix (cres) / Stria terminalis (can not be resolved with current
resolution) R_FA_Mean
   145  Fornix (cres) / Stria terminalis (can not be resolved with current
resolution) R_FA_STD
   146  Fornix (cres) / Stria terminalis (can not be resolved with current
resolution) R_MD_Mean
   147  Fornix (cres) / Stria terminalis (can not be resolved with current
resolution) R_MD_STD
   148  Body of corpus callosum_FA_Mean
   149  Body of corpus callosum_FA_STD
   150  Body of corpus callosum_MD_Mean
   151  Body of corpus callosum_MD_STD
   152  Fornix (cres) / Stria terminalis (can not be resolved with current
resolution) L_FA_Mean
   153  Fornix (cres) / Stria terminalis (can not be resolved with current
resolution) L_FA_STD
   154  Fornix (cres) / Stria terminalis (can not be resolved with current
resolution) L_MD_Mean
   155  Fornix (cres) / Stria terminalis (can not be resolved with current
resolution) L_MD_STD
   156  Superior longitudinal fasciculus R_FA_Mean
   157  Superior longitudinal fasciculus R_FA_STD
```

```
   158  Superior longitudinal fasciculus R_MD_Mean
   159  Superior longitudinal fasciculus R_MD_STD
   160  Superior longitudinal fasciculus L_FA_Mean
   161  Superior longitudinal fasciculus L_FA_STD
   162  Superior longitudinal fasciculus L_MD_Mean
   163  Superior longitudinal fasciculus L_MD_STD
   164  Superior fronto-occipital fasciculus (could be a part of anterior
internal capsule) R_FA_Mean
   165  Superior fronto-occipital fasciculus (could be a part of anterior
internal capsule) R_FA_STD
   166  Superior fronto-occipital fasciculus (could be a part of anterior
internal capsule) R_MD_Mean
   167  Superior fronto-occipital fasciculus (could be a part of anterior
internal capsule) R_MD_STD
   168  Superior fronto-occipital fasciculus (could be a part of anterior
internal capsule) L_FA_Mean
   169  Superior fronto-occipital fasciculus (could be a part of anterior
internal capsule) L_FA_STD
   170  Superior fronto-occipital fasciculus (could be a part of anterior
internal capsule) L_MD_Mean
   171  Superior fronto-occipital fasciculus (could be a part of anterior
internal capsule) L_MD_STD
   172  Uncinate fasciculus R_FA_Mean
   173  Uncinate fasciculus R_FA_STD
   174  Uncinate fasciculus R_MD_Mean
   175  Uncinate fasciculus R_MD_STD
   176  Uncinate fasciculus L_FA_Mean
   177  Uncinate fasciculus L_FA_STD
   178  Uncinate fasciculus L_MD_Mean
   179  Uncinate fasciculus L_MD_STD
   180  Tapetum R_FA_Mean
   181  Tapetum R_FA_STD
   182  Tapetum R_MD_Mean
   183  Tapetum R_MD_STD
   184  Tapetum L_FA_Mean
   185  Tapetum L_FA_STD
   186  Tapetum L_MD_Mean
   187  Tapetum L_MD_STD
   188  Splenium of corpus callosum_FA_Mean
   189  Splenium of corpus callosum_FA_STD
   190  Splenium of corpus callosum_MD_Mean
   191  Splenium of corpus callosum_MD_STD
   192  Fornix (column and body of fornix)_FA_Mean
   193  Fornix (column and body of fornix)_FA_STD
   194  Fornix (column and body of fornix)_MD_Mean
   195  Fornix (column and body of fornix)_MD_STD
   196  Corticospinal tract R_FA_Mean
   197  Corticospinal tract R_FA_STD
   198  Corticospinal tract R_MD_Mean
   199  Corticospinal tract R_MD_STD
   200  Corticospinal tract L_FA_Mean
```

```
201  Corticospinal tract L_FA_STD
202  Corticospinal tract L_MD_Mean
203  Corticospinal tract L_MD_STD
204  Medial lemniscus R_FA_Mean
205  Medial lemniscus R_FA_STD
206  Medial lemniscus R_MD_Mean
207  Medial lemniscus R_MD_STD
208  Anterior thalamic radiation L_FA_Mean
209  Anterior thalamic radiation L_FA_STD
210  Anterior thalamic radiation L_MD_Mean
211  Anterior thalamic radiation L_MD_STD
212  Forceps minor_FA_Mean
213  Forceps minor_FA_STD
214  Forceps minor_MD_Mean
215  Forceps minor_MD_STD
216  Inferior fronto-occipital fasciculus L_FA_Mean
217  Inferior fronto-occipital fasciculus L_FA_STD
218  Inferior fronto-occipital fasciculus L_MD_Mean
219  Inferior fronto-occipital fasciculus L_MD_STD
220  Inferior fronto-occipital fasciculus R_FA_Mean
221  Inferior fronto-occipital fasciculus R_FA_STD
222  Inferior fronto-occipital fasciculus R_MD_Mean
223  Inferior fronto-occipital fasciculus R_MD_STD
224  Inferior longitudinal fasciculus L_FA_Mean
225  Inferior longitudinal fasciculus L_FA_STD
226  Inferior longitudinal fasciculus L_MD_Mean
227  Inferior longitudinal fasciculus L_MD_STD
228  Inferior longitudinal fasciculus R_FA_Mean
229  Inferior longitudinal fasciculus R_FA_STD
230  Inferior longitudinal fasciculus R_MD_Mean
231  Inferior longitudinal fasciculus R_MD_STD
232  Superior longitudinal fasciculus L_FA_Mean
233  Superior longitudinal fasciculus L_FA_STD
234  Superior longitudinal fasciculus L_MD_Mean
235  Superior longitudinal fasciculus L_MD_STD
236  Superior longitudinal fasciculus R_FA_Mean
237  Superior longitudinal fasciculus R_FA_STD
238  Superior longitudinal fasciculus R_MD_Mean
239  Superior longitudinal fasciculus R_MD_STD
240  Uncinate fasciculus L_FA_Mean
241  Uncinate fasciculus L_FA_STD
242  Uncinate fasciculus L_MD_Mean
243  Uncinate fasciculus L_MD_STD
244  Uncinate fasciculus R_FA_Mean
245  Uncinate fasciculus R_FA_STD
246  Uncinate fasciculus R_MD_Mean
247  Uncinate fasciculus R_MD_STD
248  Superior longitudinal fasciculus (temporal part) L_FA_Mean
249  Superior longitudinal fasciculus (temporal part) L_FA_STD
250  Superior longitudinal fasciculus (temporal part) L_MD_Mean
251  Superior longitudinal fasciculus (temporal part) L_MD_STD
```

```
252  Anterior thalamic radiation R_FA_Mean
253  Anterior thalamic radiation R_FA_STD
254  Anterior thalamic radiation R_MD_Mean
255  Anterior thalamic radiation R_MD_STD
256  Superior longitudinal fasciculus (temporal part) R_FA_Mean
257  Superior longitudinal fasciculus (temporal part) R_FA_STD
258  Superior longitudinal fasciculus (temporal part) R_MD_Mean
259  Superior longitudinal fasciculus (temporal part) R_MD_STD
260  Corticospinal tract L_FA_Mean
261  Corticospinal tract L_FA_STD
262  Corticospinal tract L_MD_Mean
263  Corticospinal tract L_MD_STD
264  Corticospinal tract R_FA_Mean
265  Corticospinal tract R_FA_STD
266  Corticospinal tract R_MD_Mean
267  Corticospinal tract R_MD_STD
268  Cingulum (cingulate gyrus) L_FA_Mean
269  Cingulum (cingulate gyrus) L_FA_STD
270  Cingulum (cingulate gyrus) L_MD_Mean
271  Cingulum (cingulate gyrus) L_MD_STD
272  Cingulum (cingulate gyrus) R_FA_Mean
273  Cingulum (cingulate gyrus) R_FA_STD
274  Cingulum (cingulate gyrus) R_MD_Mean
275  Cingulum (cingulate gyrus) R_MD_STD
276  Cingulum (hippocampus) L_FA_Mean
277  Cingulum (hippocampus) L_FA_STD
278  Cingulum (hippocampus) L_MD_Mean
279  Cingulum (hippocampus) L_MD_STD
280  Cingulum (hippocampus) R_FA_Mean
281  Cingulum (hippocampus) R_FA_STD
282  Cingulum (hippocampus) R_MD_Mean
283  Cingulum (hippocampus) R_MD_STD
284  Forceps major_FA_Mean
285  Forceps major_FA_STD
286  Forceps major_MD_Mean
287  Forceps major_MD_STD
```

Correccion de movimiento