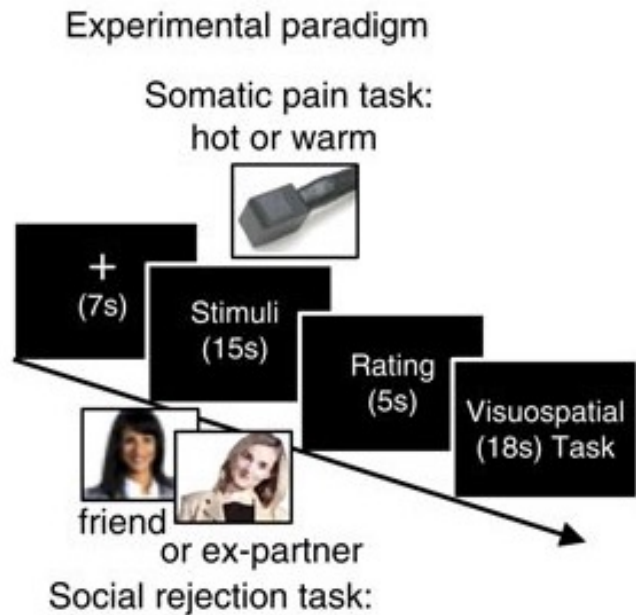


- We will compare the results from the robust regression, second-level regression with t-test using this datasets



Tasks

- Participants: $N = 59$
- There were two types of tasks, and in each task, there were two conditions (2 x 2 design)
 - Physical pain task (Heat, Warmth conditions)
 - Social pain task (Rejection, Friends conditions)
- Each subject's each condition's beta image was estimated
 - Total 4 conditions x 59 participants = 236 beta images

Data: https://github.com/cocoanlab/khbm2019_RSA_tutorial

Woo, C. W., Koban, L., Kross, E., Lindquist, M. A., Banich, M. T., Ruzic, L., ... & Wager, T. D. (2014). Separate neural representations for physical pain and social rejection. *Nature communications*, 5(1), 1-12.



Robust regression: tutorials

1. Visit **the KHBM_2019_RSA tutorial GITHUB** and clone the folder (https://github.com/cocoanlab/khbm2019_RSA_tutorial)
2. Visit **the RobustToolbox GITHUB** and clone the folder (<https://github.com/canlab/RobustToolbox>)

The walkthrough in this toolbox is also helpful (https://github.com/canlab/RobustToolbox/tree/master/robust_toolbox/Robust_regression_walkthrough)

```
%% Examples: Robust Regression Toolbox
% Written by Suhwan Gim
% Load data and mask
gitdir = '/Users/suhwan/Dropbox/github';
basedir = fullfile(gitdir, '/coursework/advancedfmrianalysis_2019fall_Week/week2/');
datdir = fullfile(basedir, 'khbm2019_RSA_tutorial/tutorial/data/contrast_images');
% addpath(genpath(~canlabCORE)) % github.com/canlab/canlabCORE
% addpath(genpath(~cocoanCORE)) % github.com/cocoanlab/cocoanCORE
% addpaht(genpath(~RobustRegressionToolbox)); % github.com/canlab/RobustToolbox
maskdir = fullfile(basedir, 'khbm2019_RSA_tutorial', 'tutorial', 'masks');
AImask = fullfile(maskdir, 'aINS_smooth_mirror.nii');
dACCmask = fullfile(maskdir, 'dACC_smooth_mirror.nii');
gmmask = which('gray_matter_mask.nii');
```



3. Load fMRI data with mask

```
friend_beta = filenames(fullfile(datdir, 'friend*.nii'));  
reject_beta = filenames(fullfile(datdir, 'reject*.nii'));  
% load fMRI data with Anterior Insula mask  
dat_friend = fmri_data(friend_beta, dACCmask);  
dat_reject = fmri_data(reject_beta, dACCmask);
```

4. t-test against zero for each condition

```
stats_img1=ttest(dat_friend,0.001,'fdr');  
stats_img2=ttest(dat_reject,0.001,'fdr');  
t_friend=threshold(stats_img1,'k',10); % contiguous voxels < 10 will be removed  
canlab_results_fmridisplay(region(t_friend));
```

5. Robust regression using function 'fmri_data.regress' in CanlabCORE

```
%% RUN ROBUST REGRESSION WITH fmri_data.regress fucntion  
dat_friend = fmri_data(friend_beta, gmmask);  
dat_friend.X = ones(1,59)';  
out_robust = regress(dat_friend, .05, 'unc', 'robust', 'nodisplay');  
%orthviews(threshold(out_robust.b,.001,'fdr','k',10));  
canlab_results_fmridisplay(region(threshold(out_robust.b,.001,'fdr','k',10)));
```



6. Robust regression using function 'robfit' in RobustToolbox

```
%% RUN ROBUST REGRESSION using ROBUST REGRESSION TOOLBOX
% 1. First we should make EXPT data structure
% =====
% EXPT.SNPM.P      Cell vector. Each cell specifies images for one analysis.
%                  Each cell contains a string matrix with image names for the analysis.
%                  Image files can be 3-D or 4-D images.
%
% EXPT.SNPM.connames Cell vector.
%                  Each cell contains a string with the analysis name (e.g., contrast).
%
% EXPT.SNPM.connums  Vector of contrast numbers.
%                  Determines folder names (e.g., 1 = robust0001)
%
% EXPT.cov           [n x k] matrix of n observations (must match number of images)
%
% EXPT.mask          Optional mask file image name, for voxels to include
% =====
EXPT = [];
friend_beta_char = filenames(fullfile(datdir, 'friend*.nii'), 'char');
EXPT.SNPM.P{1} = friend_beta_char; % We could have multiple analyses in {2} etc.
EXPT.SNPM.connames = {'friend vs. zero'}; % name of model
EXPT.SNPM.connums = 1; % number of model
%EXPT.mask = fullfile(maskdir, 'dACC_smooth_mirror.nii');
EXPT.mask = which('gray_matter_mask.nii');
EXPT.cov = [ones(1,59)'];
EXPT = robfit(EXPT, 1:length(EXPT.SNPM.connums), 0, EXPT.mask);
```



7. Visualization

```
%% Visualiazation
robustdir = '/Users/suhwan/Documents/rob/robust0001/robust0001/robust0001/robust0001'
effect_img = fullfile(robustdir, 'rob_beta_0001.nii'); % or 'rob_beta_0001.img'
pval_img = fullfile(robustdir, 'rob_p_0001.nii'); % or 'rob_p_0001.img'
mask_img = fullfile(robustdir, 'mask.nii'); % or 'rob_beta_0001.img'

rob_dat = statistic_image('image_names', effect_img, 'type', 'generic');
[datp, volInfo] = iimg_threshold(pval_img, 'mask', mask_img);

datp(datp == 0 & isnan(rob_dat.dat)) = NaN;
rob_dat.p = datp;
rob_dat_th=threshold(rob_dat, 0.001, 'fdr', 'k', 10);
canlab_results_fmridisplay(region(rob_dat))
```

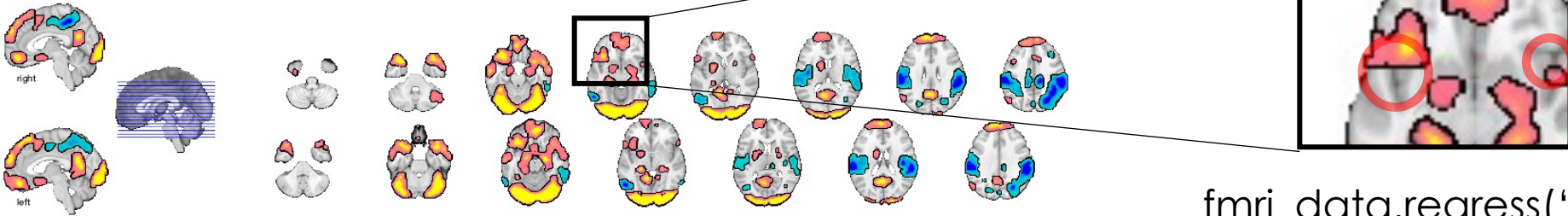
Woo, C. W., Koban, L., Kross, E., Lindquist, M. A., Banich, M. T., Ruzic, L., ... & Wager, T. D. (2014). Separate neural representations for physical pain and social rejection. *Nature communications*, 5(1), 1-



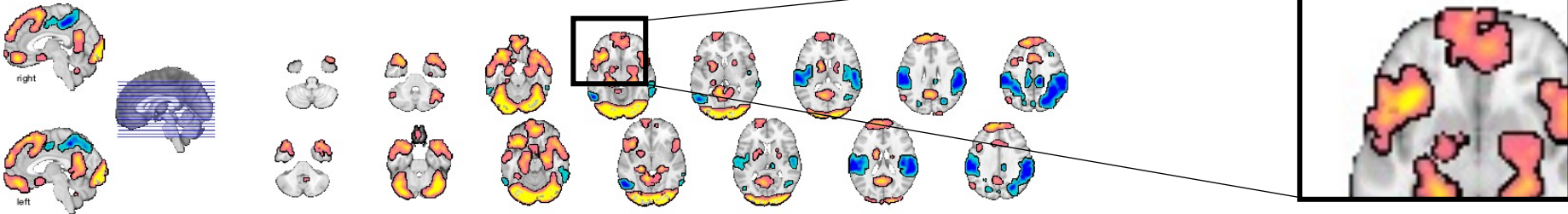
Robust regression: tutorials

Thresholding (FDR 0.001 with $k > 10$)

1. t-test



2. `fmri_data.regress('robust')`



3. `robfit` (Robust regression toolbox)



`fmri_data.regress('robust')`

`robfit` (Robust regression toolbox)

