```
clear; clc; close all;

%--------------------------------------------------------------------------
%   Variable
%--------------------------------------------------------------------------

parIndexSet        = [1 2 3];

ROINameSet         = ["HPC" "aPFC" "dlPFC" "HPC1" "HPC2" "HPC3" "HPC4" "EVC" "LOC"]

nStims             = 40;       % Number of tested stimuli

nRuns              = 4;        % Number of repetitions (1 run = 1 learning + 1 retrieval)

tasktype           = 'RET';

dir_PatternCorr     = './Pattern_Correlation/';
%% Load Behavioral data and Correlation Data
AllCorr = cell(1,length(parIndexSet));
TotData = cell(nRuns,length(parIndexSet));

for parIndex = parIndexSet
   cPar = parIndex;

   for fileInd = 1:nRuns
      cFile =
strcat('./Behavior/P00',num2str(cPar),'/Retrieval/run',num2str(fileInd),'_RET_Data.txt');   %
Each participant's behavioral data file name
      cData = fopen(cFile,'r');
      formatSpec = '%s %s %s %s %s %s %s %s';
      A = textscan(cData,formatSpec);

      % Each file is (Trials * 7) matrix. 40*7 for this Study.
      % 1st Column : Object number, 6th Column : Correctness of response
      % 7th Column : Confidence Rating

      for cObject = 1:nStims
         for i = 1:8
            TotData{fileInd,parIndex}(cObject,i) = A{1,i}(cObject,1);
         end
      end
   end
```

```
    PatternCorrName = strcat(dir_PatternCorr,'P00',num2str(cPar),'_',tasktype,'.cor.mat');
    load(PatternCorrName);

    AllCorr{1,parIndex} = All_corrMatrix;

   % Load data containing correlation data
   % AllCorr is a matrix containing correlation data of ROIs of
   % participants. It is 1*Participants cell.
   % Each cell is Trials*Trials*ROIs matrix (160*160*9 for this study)

end

HCcorr = [];   % Matrix for High-Confidence Within-Comparison Corresponding indices
LCcorr = [];   % Matrix for Low-Confidene Within-Comparison Corresponding indices
HCcorr2 = [];  % Matrix for High-Confidence Between-Comparison Corresponding indices
LCcorr2 = [];  % Matrix for Low-Confidence Between-Comparison Corresponding indices

for parInd = 1:length(parIndexSet)
    cPar = parIndexSet(parInd);

    %% Define subjective range

    % Define Max and Min Confidence Range of FA trials
    minCF = 100;
    maxCF = 0;
    for trialInd = 1:160
        objnum = str2double(cell2mat(TotData{1,cPar}(mod(trialInd-1,40)+1,1)));    % Object
presented in the trial
        score = str2double(cell2mat(TotData{fix((trialInd-1)/40)+1,cPar}(mod(trialInd-
1,40)+1,6)));   % Score of response. 1 : Correct, 0: Wrong, -1 : No response
        conf = str2double(cell2mat(TotData{fix((trialInd-1)/40)+1,cPar}(mod(trialInd-
1,40)+1,7)));    % Confidence Rating (0 ~ 100)
        isnew = 0;  % indicator representing whether the object was learned or not (0: learned, 1:
non-learned)
        if objnum > 40 || mod(objnum,2) == 0  % If current object is non-learned
            isnew = 1;
        end
        if conf == 0 || score == -1   % Exclude trials if confidence rating is 0 or there was no
response
            continue
        end
        if score == 0 && isnew == 1   % Check if it is FA trial
            if conf<minCF
                minCF = conf;   % Searching min Confidence rating
```

```
        end
        if conf>maxCF
            maxCF = conf;   % Searching max Confidence rating
        end
      end
   end
   minRan = [minCF,minCF+10,minCF+20];  % Low-Confidence Range
   maxRan = [maxCF-20,maxCF-10,maxCF];  %High-Confidence Range

   if minCF+20 >= maxCF-20  % Exclude the participant if the min and max confidence ranges
overlap
      continue
   end

   %% FA-Hit correlation Analysis
   Temp1 = [];
   Temp2 = [];
   Temp3 = [];
   Temp4 = [];
   for trialInd1 = 1:160   % Trial1 (FA trial)
      objnum = str2double(cell2mat(TotData{fix((trialInd1-1)/40)+1,cPar}(mod(trialInd1-
1,40)+1,1)));  % Object presented in the trial
      score = str2double(cell2mat(TotData{fix((trialInd1-1)/40)+1,cPar}(mod(trialInd1-
1,40)+1,6)));   % Score of response. 1 : Correct, 0: Wrong, -1 : No response
      conf = str2double(cell2mat(TotData{fix((trialInd1-1)/40)+1,cPar}(mod(trialInd1-
1,40)+1,7)));    % Confidence Rating (0 ~ 100)
      isnew = 0;
      if objnum > 40 || mod(objnum,2) == 0
         isnew = 1;
      end

      if conf == 0 || score == -1
         continue
      end
      CI = [];
      T1 = [];
      T2 = [];
      T3 = [];
      T4 = [];

      if (score == 0 && isnew == 1) && objnum < 41  % Check if trial1 is FA trial
         %% Within-Comparison
         for trialInd2 = 1:160     % Trial2 (Hit trial)
```

```
            objnum2 = str2double(cell2mat(TotData{fix((trialInd2-1)/40)+1,cPar}(mod(trialInd2-
1,40)+1,1)));
            score2 = str2double(cell2mat(TotData{fix((trialInd2-1)/40)+1,cPar}(mod(trialInd2-
1,40)+1,6)));
            conf2 = str2double(cell2mat(TotData{fix((trialInd2-1)/40)+1,cPar}(mod(trialInd2-
1,40)+1,7)));
            isnew2 = 0;
            if objnum2 > 40 || mod(objnum2,2) == 0
               isnew2 = 1;
            end

            if objnum ~= objnum2 + 1     % Check if the object category is same (Within-
Comparison)
               continue
            elseif conf2 == 0
               continue
            elseif isnew2 == 1 || score2 ~= 1    % Check if trial2 is Hit trial
               continue
            end

            CI = cat(1,CI,squeeze(AllCorr{1,cPar}(trialInd1, trialInd2, :))'); % Corresponding Index
between trial1(FA) & trial2(Hit)
            if isempty(find(maxRan == conf)) == 0    % If confidence belongs to High-Confidence
range
               T1 = cat(1,T1,CI);   % Stack corresponding indices of High-Confidence FA trials
            elseif isempty(find(minRan == conf)) == 0     %If confidence belongs to Low-Confidence
range
               T2 = cat(1,T2,CI);   % Stack corresponding indices of High-Confidence FA trials
            end
         end

         if isempty(CI) == 1
            continue
         end

         if isempty(find(maxRan == conf)) == 0
            Temp1 = cat(1,Temp1,nanmean(T1,1)); % Stacking mean corresponding index of High-
Confidence within-comparison
         elseif isempty(find(minRan == conf)) == 0
            Temp2 = cat(1,Temp2,nanmean(T2,1)); % Stacking mean corresponding index of Low-
Confidence within-comparison
         end

         %% Between-Comparison
```

```
        for trialInd2 = 1:160
            t = [];
            objnum2 = str2double(cell2mat(TotData{fix((trialInd2-1)/40)+1,cPar}(mod(trialInd2-
1,40)+1,1)));
            score2 = str2double(cell2mat(TotData{fix((trialInd2-1)/40)+1,cPar}(mod(trialInd2-
1,40)+1,6)));
            conf2 = str2double(cell2mat(TotData{fix((trialInd2-1)/40)+1,cPar}(mod(trialInd2-
1,40)+1,7)));
            isnew2 = 0;
            if objnum2 > 40 || mod(objnum2,2) == 0
                isnew2 = 1;
            end

            if objnum == objnum2 + 1 % Check if the object category is different (Between-
Comparison)
                continue
            end


            if conf2 == 0
                continue
            elseif score2 ~= 1 || isnew2 == 1
                continue

            end
            CI = cat(1,CI,squeeze(AllCorr{1,cPar}(trialInd1, trialInd2, :))');
            if isempty(find(maxRan == conf)) == 0  % If confidence belongs to High-Confidence
range
                T3 = cat(1,T3,CI); % Stack corresponding indices of High-Confidence FA trials
            elseif isempty(find(minRan == conf)) == 0 % If confidence belongs to Low-Confidence
range
                T4 = cat(1,T4,CI); % Stack corresponding indices of Low-Confidence FA trials
            end
        end

        if isempty(CI) == 1
            continue
        end

        if isempty(find(maxRan == conf)) == 0
            Temp3 = cat(1,Temp3,nanmean(T3,1)); % Stacking mean corresponding index of High-
Confidence between-comparison
        elseif isempty(find(minRan == conf)) == 0
```

```
            Temp4 = cat(1,Temp4,nanmean(T4,1)); % Stacking mean corresponding index of Low-
Confidence between-comparison
         end
      end
   end

   if isempty(Temp1) == 1 || isempty(Temp2) == 1  % Skip the subject if there is no High- or
Low-Confidence within-comparison case
      continue
   end

   if isempty(Temp3) == 1 || isempty(Temp4) == 1 % Skip the subject if there is no High- or Low-
Confidence between-comparison case
      continue
   end

   % Exclude the participant if any of 4 conditions ( High-CF
   % Within-Comparison, Low-CF Within-Comparison, High-CF Between-
   % Comparison, Low-CF Between-Comparison) is empty.

   Temp1 = nanmean(Temp1,1);
   Temp2 = nanmean(Temp2,1);
   Temp3 = nanmean(Temp3,1);
   Temp4 = nanmean(Temp4,1);
   HCcorr = cat(1,HCcorr,Temp1(:,:));  % Store mean Correlation Value for High-Confidence
Within-Comparison of each participants
   LCcorr = cat(1,LCcorr,Temp2(:,:));  % Store mean Correlation Value for Low-Confidence
Within-Comparison of each participants
   HCcorr2 = cat(1,HCcorr2,Temp3(:,:)); % Store mean Correlation Value for High-Confidence
Between-Comparison of each participants
   LCcorr2 = cat(1,LCcorr2,Temp4(:,:)); % Store mean Correlation Value for Low-Confidence
Between-Comparison of each participants

end


%% Plots
tresults = zeros(8,length(ROINameSet));
tresults2 = zeros(8,length(ROINameSet));
ROIs = [1,2,3,4,5,6,7,8,9];
for ROIInd = ROIs
   [q, p, ci, stat] = ttest(HCcorr(:,ROIInd),LCcorr(:,ROIInd));
   tresults(1:2,ROIInd) = [q;p];
   [q, p, ci, stat] = ttest(HCcorr2(:,ROIInd),LCcorr2(:,ROIInd));
```

```
   tresults(3:4,ROIInd) = [q;p];
   [q, p, ci, stat] = ttest(HCcorr(:,ROIInd),HCcorr2(:,ROIInd));
   tresults(5:6,ROIInd) = [q;p];
   [q, p, ci, stat] = ttest(LCcorr(:,ROIInd),LCcorr2(:,ROIInd));
   tresults(7:8,ROIInd) = [q;p];
   [q, p, ci, stat] = ttest(HCcorr(:,ROIInd));
   tresults2(1:2,ROIInd) = [q;p];
   [q, p, ci, stat] = ttest(LCcorr(:,ROIInd));
   tresults2(3:4,ROIInd) = [q;p];
   [q, p, ci, stat] = ttest(HCcorr2(:,ROIInd));
   tresults2(5:6,ROIInd) = [q;p];
   [q, p, ci, stat] = ttest(LCcorr2(:,ROIInd));
   tresults2(7:8,ROIInd) = [q;p];


   Y =
[nanmean(HCcorr(:,ROIInd)),nanmean(LCcorr(:,ROIInd));nanmean(HCcorr2(:,ROIInd)),nanmean(
LCcorr2(:,ROIInd))];
   Z =
[nanstd(HCcorr(:,ROIInd))/sqrt(size(HCcorr(:,ROIInd),1)),nanstd(LCcorr(:,ROIInd))/sqrt(size(LCco
rr(:,ROIInd),1));nanstd(HCcorr2(:,ROIInd))/sqrt(size(HCcorr2(:,ROIInd),1)),nanstd(LCcorr2(:,ROIIn
d))/sqrt(size(LCcorr2(:,ROIInd),1))];
   figure(ROIInd)
   hold on
   T = strcat('FA-Hit correlation - ',ROINameSet(ROIInd));
   if ROINameSet(ROIInd) == "MFG"
      T = "FA-Hit correlation - dlPFC";
   end
   title(T)
   ngroups = size(Y, 1);
   nbars = size(Y, 2);
   groupwidth = min(0.8, nbars/(nbars + 1.5));
   for i = 1:nbars
      x = (1:ngroups) - groupwidth/2 + (2*i-1) * groupwidth / (2*nbars);
      k(:,i) = x;
      if i == 1
         x1 = bar(x,Y(:,i),0.2,'FaceColor',[0 0.2 1])
      elseif i == 2
         x2 = bar(x,Y(:,i),0.2,'FaceColor',[1 0.2 0])
      elseif i == 3
         x3 = bar(x,Y(:,i),0.2,'FaceColor',[1 0.8 0.5])
      end
      errorbar(x, Y(:,i), Z(:,i), 'k.');
```

```
    end

    if tresults2(1,ROIInd) == 1
        plot(k(1,1),max(Y(1,1)+Z(1,1),abs(Y(1,1))*0.2),'r*');
    end
    if tresults2(3,ROIInd) == 1
        plot(k(1,2),max(Y(1,2)+Z(1,2),abs(Y(1,2))*0.2),'r*');
    end
    if tresults2(5,ROIInd) == 1
        plot(k(2,1),max(Y(2,1)+Z(2,1),abs(Y(2,1))*0.2),'r*');
    end
    if tresults2(7,ROIInd) == 1
        plot(k(2,2),max(Y(2,2)+Z(2,2),abs(Y(2,2))*0.2),'r*');
    end

    MAX = max([Y(1,1)*1.1+Z(1,1),Y(1,2)*1.1+Z(1,2),Y(2,1)*1.1+Z(2,1),Y(2,2)*1.1+Z(2,2)]);
    m = MAX * 0.1;
    if tresults(1,ROIInd) == 1
        line([k(1,1),k(1,2)],[MAX,MAX],'Color','k')
        MAX = MAX+m;
    end
    if tresults(3,ROIInd) == 1
        line([k(2,1),k(2,2)],[MAX,MAX],'Color','k')
        MAX = MAX+m;
    end
    if tresults(5,ROIInd) == 1
        line([k(1,1),k(2,1)],[MAX,MAX],'Color','k')
        MAX = MAX+m;
    end
    if tresults(7,ROIInd) == 1
        line([k(1,2),k(2,2)],[MAX,MAX],'Color','k')
        MAX = MAX+m;
    end

    legend([x1 x2],{'high confidence trial','low confidence trial'})
    xticks([1:2])
    xticklabels({"Within-Category","Between-Category"})
    hold off
end

for ROIInd = 1:length(ROINameSet)

    if tresults(1,ROIInd) == 1
        ROINameSet(ROIInd)
```

```
    end
end
fclose('all');
```