Originally from Nathan Killian, to Liz Ann Amadei, to Jim Kwon

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Here's some Granger causality analysis code and a book chapter on GCA. Below are some notes on how I have setup the code:

Nathan

The folder 'gagca' should be placed in your Matlab path. gagca\_SELFP....m is what I used for batching the computations and saving the values for every possible pair as .mat files (you only need to run it for A and B or B and A, not both). The granger\_plotting...m is for plotting the results. You'll probably have to edit most of those scripts to fit your experiment, but the important loop is where the 'nchoosek' is run to get the possible pairs and the script 'gagca.m' is called to do the computations:

superinds = [4:8]; % channel indices in your data matrix, e.g. just the superficial channels

        disp('doing causality analysis')

        if length(super)>1

            Cs = nchoosek(superinds,2);

            for superset = 1:size(Cs,1)

                ch1 = Cs(superset,1);

                ch2 = Cs(superset,2);

                if ch1 == ch2, continue;end

                fname=[newmatdir fid  '\_CSDencrec\_' num2str(good(ch1)) '\_' num2str(good(ch2)) '.mat'];

                disp(fname)

                winsize = 150;

                windowstep = 10;

                maxsteps = floor((diff(tset)\*1000-winsize)/windowstep);

                stage=maxsteps; % total window steps

                for ia=1:stage %do entire analysis separately for each window and condition

                    for ja=1:2 %condition

                        if ja == 1, Nr = Nr1;elseif ja == 2, Nr = Nr2;end

                        LFPsignalA = squeeze(data\_all{ja}(:,ch1,:));%samples x trials

                        LFPsignalB = squeeze(data\_all{ja}(:,ch2,:));

                        %150 datapts, Data is samples x channel x trial

                        Data=zeros(winsize,2,Nr);

                        for ka=1:Nr

                            Data(:,1,ka)=LFPsignalA(1+(ia-1)\*windowstep:1+(ia-1)\*windowstep+149,ka);%sig 1, up/top

                            Data(:,2,ka)=LFPsignalB(1+(ia-1)\*windowstep:1+(ia-1)\*windowstep+149,ka);%sig 2, down/bottom

                        end

                        gagca;

                    end

                end

                clear OrderT gbottomupsel gtopdownsel gseltmp hsel pcsel R0hat nspec pcsellAll R0hatAll v logres cic pchat psel fsic ARloop Data

                clear data;

                clear LFPsignalA;

                clear LFPsignalB;

                clear TypeAStartin TypeAStartout TypeAStart Startin Startout;

                clear TypeAEnd;

                save(fname, 'TypeACoh', 'TypeAGrangerDown', 'TypeAGrangerUp', 'TypeAOrder','tset','super','good')

                clear TypeACoh TypeAGrangerDown TypeAGrangerUp TypeAOrder tmp LFP1signal LFP2signal AD15 AD16 LFP1filename LFP2filename LFP1fname LFP2fname

                disp('finished analyzing pair')

            end

        end