



INTERNATIONAL INSTITUTE OF  
INFORMATION TECHNOLOGY

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H Y D E R A B A D

## **MUSIC MIND & TECHNOLOGY**

**Submitted to :**

Dr. Vinoo Aluri

### **ASSIGNMENT – 4**

**Submitted by :**

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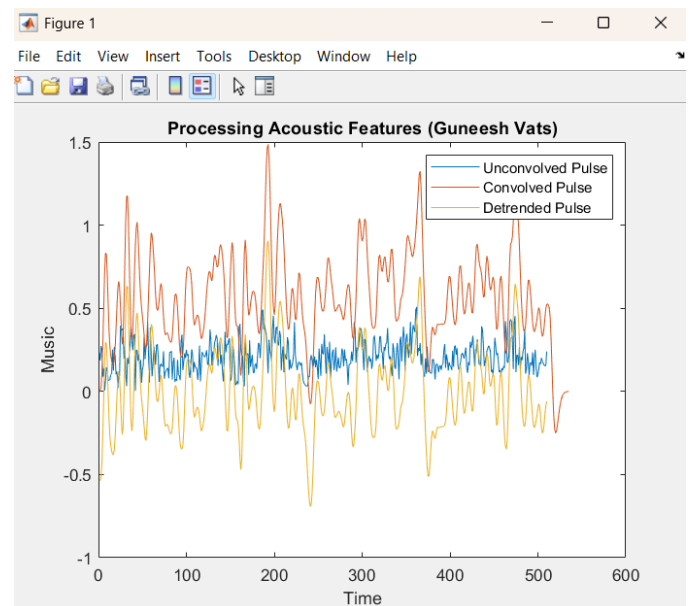
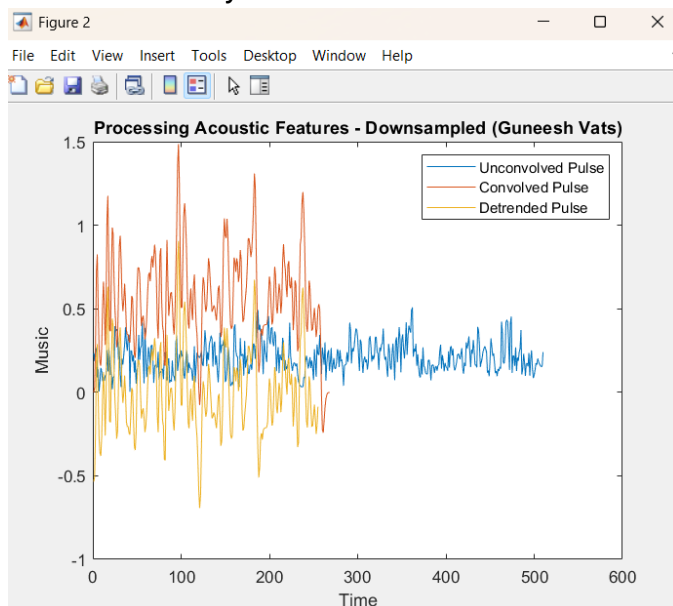
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# processing acoustic features

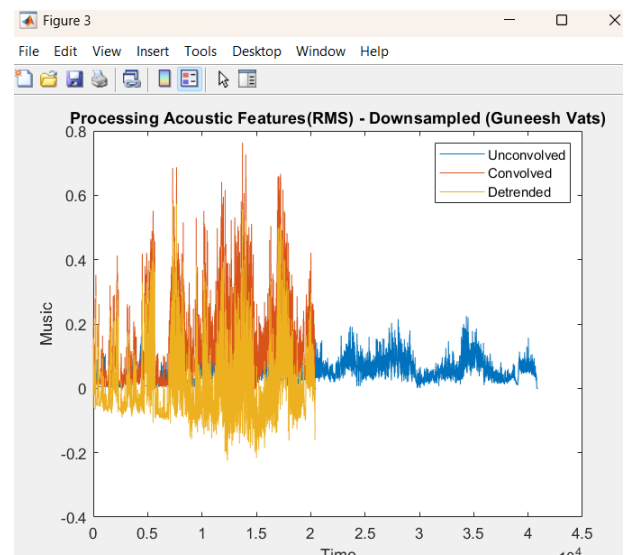
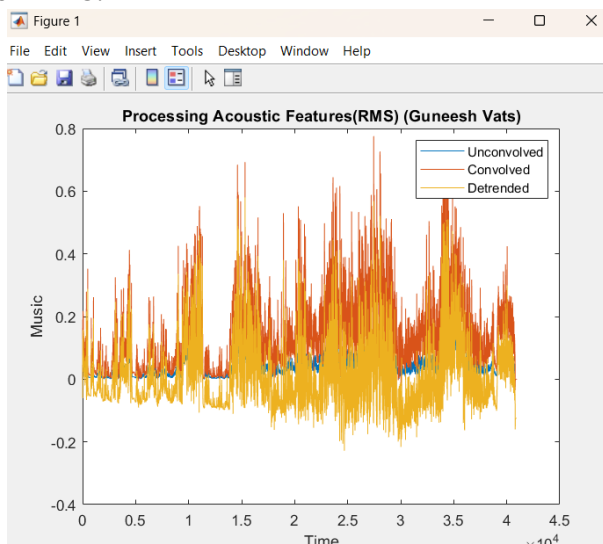
1. Extract RMS and Pulse Clarity using the MIRToolbox using a frame-based approach for the stimulus titled *fmri\_music\_stimulus.mp3*.
  - a. RMS parameters: 25ms window with 50% overlap
  - b. Pulse Clarity parameters: 3s window with 2s overlap
2. Convolve the feature with the hemodynamic response function (HRF) followed by a detrending operation. (use *fmri\_doublegamma*, *fmri\_detrend*). Make sure that the temporal resolution of the HRF matches the feature's before convolving.
3. Plot the unconvolved, convolved, and detrended and comment on it.
4. Downsample them to match the sampling rate of the fMRI data (TR = 2 sec).
5. What perceptual changes in the audio occur during peaks (when compared to the valleys) of each of the features? Is the feature perceptually relevant?

Plots obtained are:

For Pulse Clarity:



For RMS:

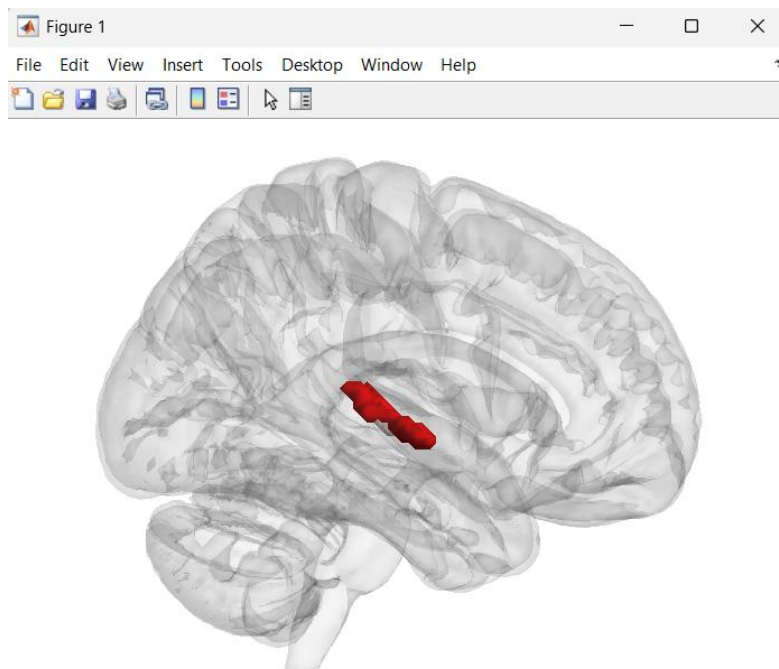


# musicians vs non-musicians

## a. mean ISC

1. Download fmri data of any 5 musicians and 5 non-musicians from [https://drive.google.com/drive/folders/1\\_S2dPUNoPtl3tnL4cmA\\_XXrVfaj7rX8](https://drive.google.com/drive/folders/1_S2dPUNoPtl3tnL4cmA_XXrVfaj7rX8).
2. For each participant group, perform voxel-wise inter-subject correlation (ISC) analysis (use *fmri\_corrvoldata*). Calculate mean ISC per group and display the results using *fmri\_show3d*. Display the most significant correlations by thresholding (ex: mean  $r > 0.3$  or 0.4). Which regions have the highest mean ISC for the groups?

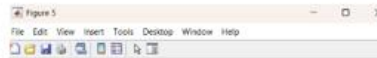
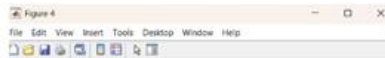
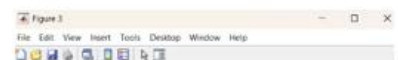
**For Musicians:**



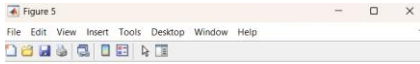
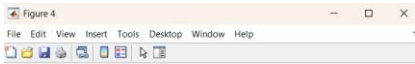
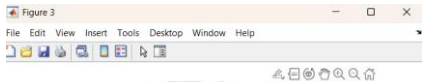
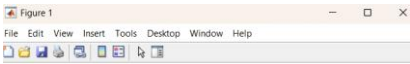
## b. neural correlates of acoustic features

1. Download *musicalfeatures.mat*. Store the features for the concatenated stimuli (i.e., *feat{1,1}*) in a separate variable. This is a matrix of size  $t \times n$  where  $t$  refers to time-points and  $n$  refers to acoustic component. They are ordered as mentioned in the variable *featlbl*.
2. At an individual level, perform voxel-wise correlation with the following features: *Brightness & Pulse Clarity* (Use function *fmri\_corregressor*). Plot the results for each participant by showing the highest (and lowest) correlations (e.g: *fmri\_show3d(c>0.25)*, *fmri\_show3d(c<-0.25)*).
3. Which feature demonstrates similarities across participant groups? Comment on your observations.

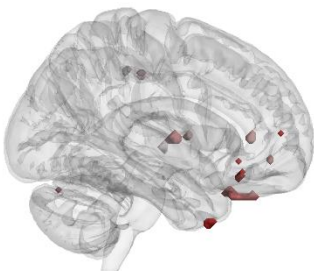
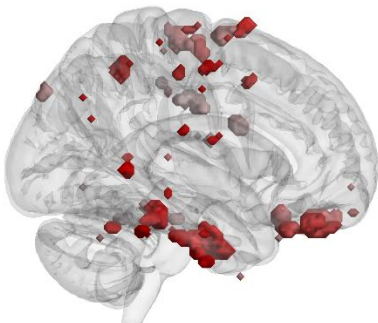
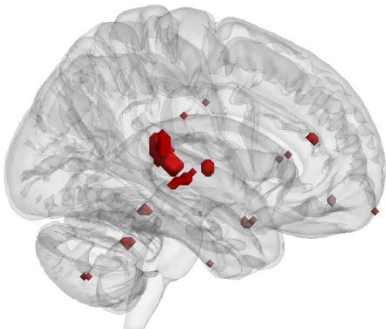
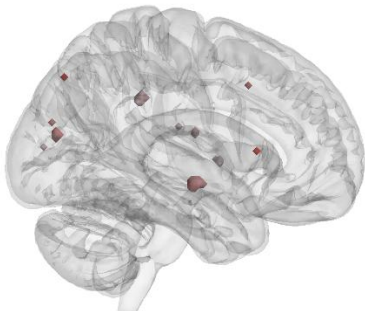
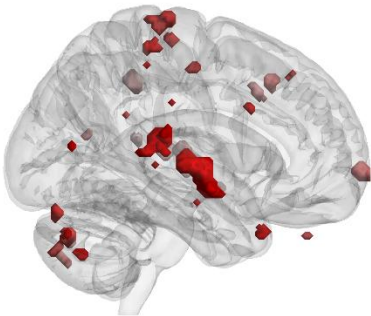
For Musicians *brightness*:



For Musicians *Pulse Clarity*:

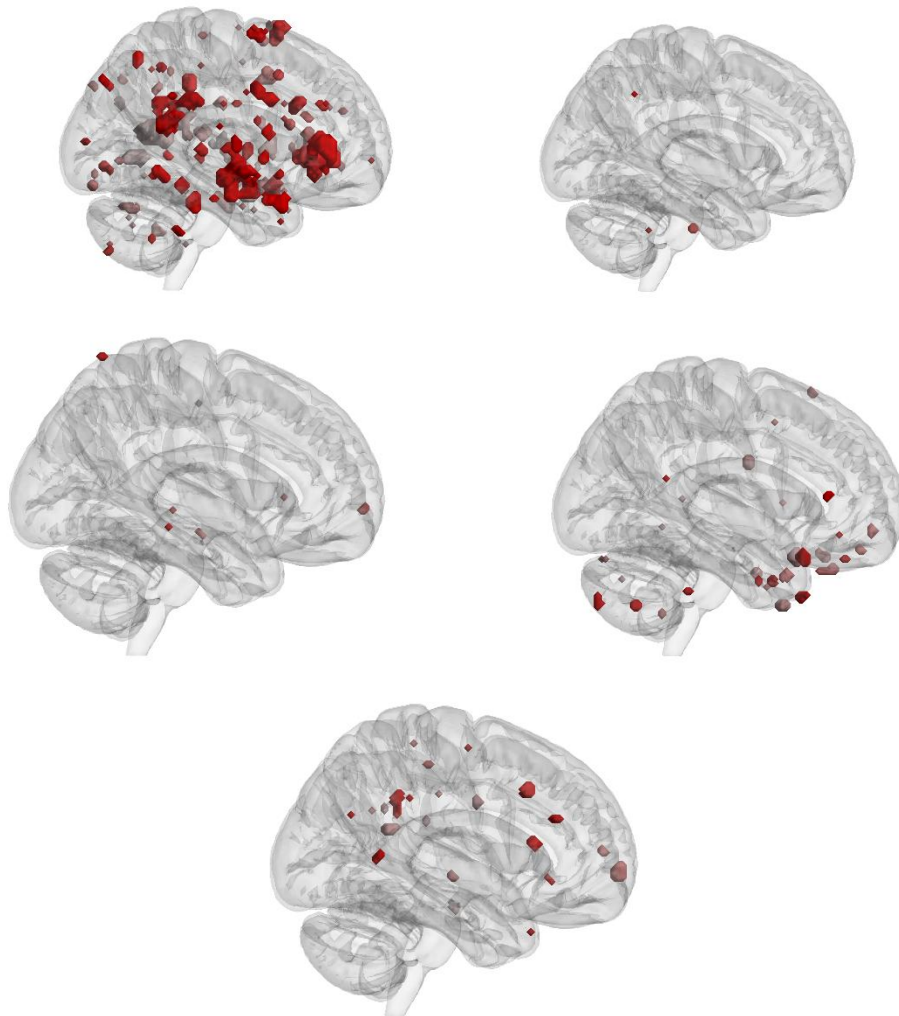


For Non-Musicians *brightness*:





### **For Non-Musicians *Pulse Clarity*:**



Answer 3.

We can observe from the obtained 3D images of involved regions of brain that the major difference between musicians and non musicians showed greater activation in the auditory cortex, specifically the superior temporal gyrus, when processing musical stimuli with high brightness and pulse clarity compared to non-musicians also we can observe that musicians had greater activation in the left middle temporal gyrus and the left inferior frontal gyrus when processing stimuli with high pulse clarity compared to non-musicians.

Musicians have enhanced neural processing of musical features related to brightness and pulse clarity in the auditory cortex and associated brain regions. However, the specific brain regions involved may vary depending on the exact nature of the musical stimuli and the population being studied.