

# BCI2000: 2D CONTROL

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# Getting Started

- Follow the Passive Stimulus Presentation Data Collection Tutorial on the wiki
  - ▣ However, when the tutorial tells you to run StimPresentation run IpsiHand\_Cursor Task instead
  - ▣ Also when you load the parameters, load IpsiHand\_LPR\_CursorTask\_CR instead

# Getting Data

- Before pressing start, make sure that ‘cursor task’ (the gridded window in the upper-left corner) is visible
- To move the ball to the right move your right hand.
  - ▣ Be sure to not move your head, blink, swallow, or move other muscles
  - ▣ Move your hand in a way that takes effort (eg. Play an imaginary piano, touch individual fingers together...)
- To move the ball to the left do not move at all
- In between trials it’s ok to blink

# Analyzing the Data

- Follow the directions in User Tutorial: Performing Offline EEG Analysis
  - After instructed to click the “add” button, navigate to data\[your initials]\[most recent data file] instead of the three files suggested by the tutorial
  - For Condition 1 enter `states.TargetCode == 1`
  - For Condition 2 enter `states.TargetCode == 2`
  - For Trial Change Condition enter `Feedback == 1`
  - Set Label 1 to “Pause” and Label 2 to “Right hand”
- Looking at the correlation maps, you want to see a few brightly colored bands in the sections between 9 and 24 Hz, and channels 1-4
- The greater the correlation the better! Keep practicing and try to get your correlations above 0.20
- Repeat data collection and analysis steps multiple times until you feel like you have some 1D control over the ball.

# Homework 1:

## Troubleshooting in BCI2000

- Run the CursorTask batch file
- Load the parameters called CursorTask\_WithErrors
- Fix the errors and press set Config
- If you still get errors, try again!

# Homework 2: Adjusting the Linear Classifier

- Run the cursor task batch file and load the parameters IpsiHand\_LPR\_CursorTask\_CR
- Change the Linear Classifier so that you have 2D control (add electrodes mapping to output channel 2)
  - ▣ Output channel 2 can be different frequencies or different electrodes than output channel 1.
  - ▣ Change it up until you have at least a little bit of control over the ball
  - ▣ If you have complete control over the ball, you achieved the goal of the project!

# Homework 3: Improving 2D Control

- Open a data set in matlab using the command like:
  - `[signal states parameters] = load_bcidat('C:\Users\Colleen\Dropbox\IpsiHand\BCI 2000\data\CR001\CRS001R04.dat');`
    - ▣ Except adjust the path so that MatLab loads your data file
- The variable “signal” should have 14 columns for the 14 electrodes
  - ▣ Create a new matrix made up of the electrodes from the signal that you care about

# Improving 2D Control continued

- **Run the command:** `[coeff,score] = princomp(signal_new);`
- **Look at the coeff matrix**
  - ▣ The first column is the best weights for each electrode in the 1<sup>st</sup> dimension and the second column is the best weights in the 2<sup>nd</sup> dimension
- **Go back to the linear classifier and try the new weights and see if CursorTask becomes easier**
  - ▣ Repeat the directions from the slide “Analyzing the Data”



# Solution Homework 1

- Make the spatial filter a 4x4 identity matrix
- Repeat the first number for NormalizerOffsets, NormalizerGains, and Adaptation
- Add a high pass filter
- Change the SourceChOffset to fourteen zeros
- Change the SourceChGain to fourteen ones

# Possible Solution Homework 2

	Input Channel	Input element (bin)	Ouput Channel	Weight
1	1	12Hz	1	-0.025
2	2	1Hz	1	-0.025
3	3	12Hz	1	-0.025
4	4	12Hz	1	-0.025
5	11	12Hz	2	-0.025
6	12	12Hz	2	-0.025
7	13	12Hz	2	-0.025
8	14	12Hz	2	-0.025