

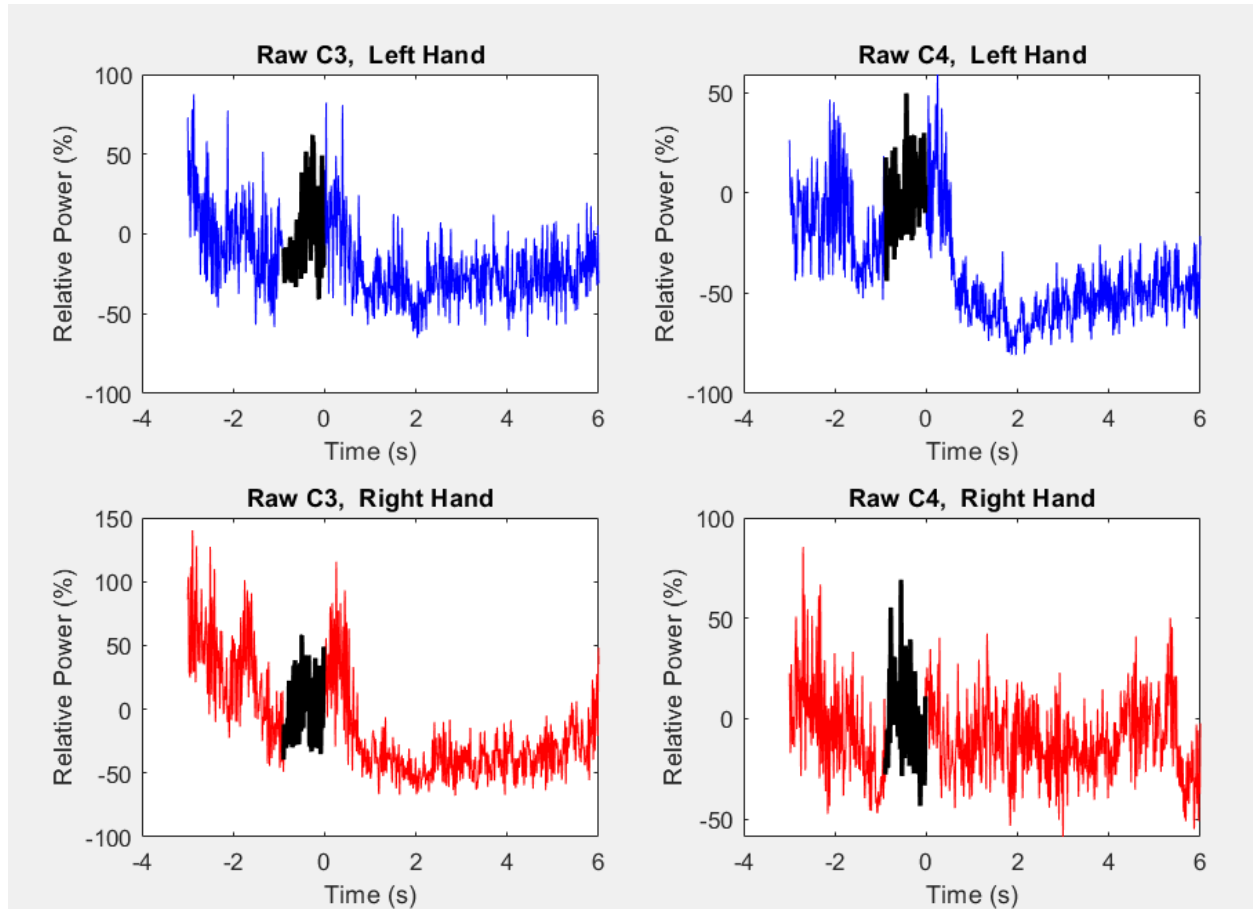
Due: Monday March 6

nkothiya

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SYDE544- Assignment 3

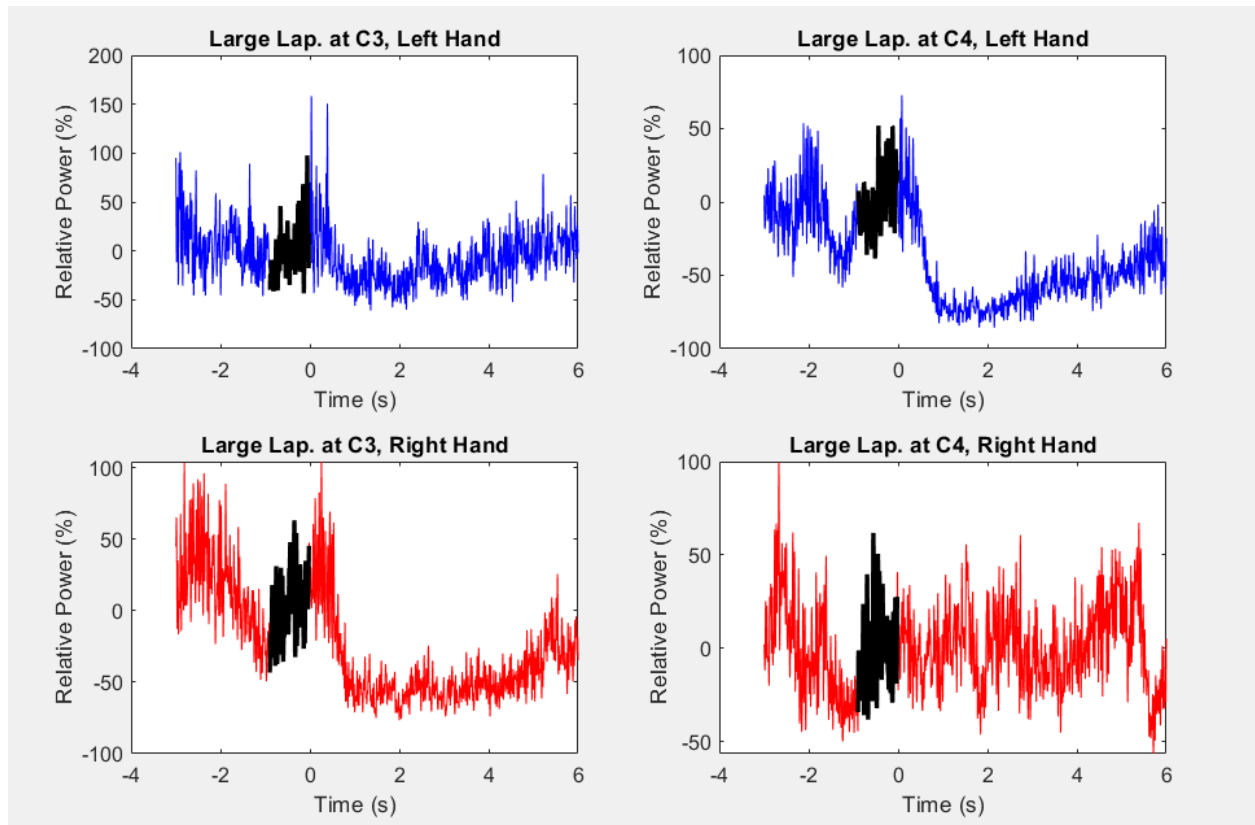
Problem 1



It can be observed that there is a decrease in power in the C4 electrode after the baseline period during the left hand task, suggesting an event-related desynchronization (ERD). This makes sense since the C4 electrode is on the right side of the brain, contralateral to the left hand task. Because the C3 electrode is an ipsilateral portion of the brain (left side), it is not involved in the left hand task and there is no significant increase or decrease in power.

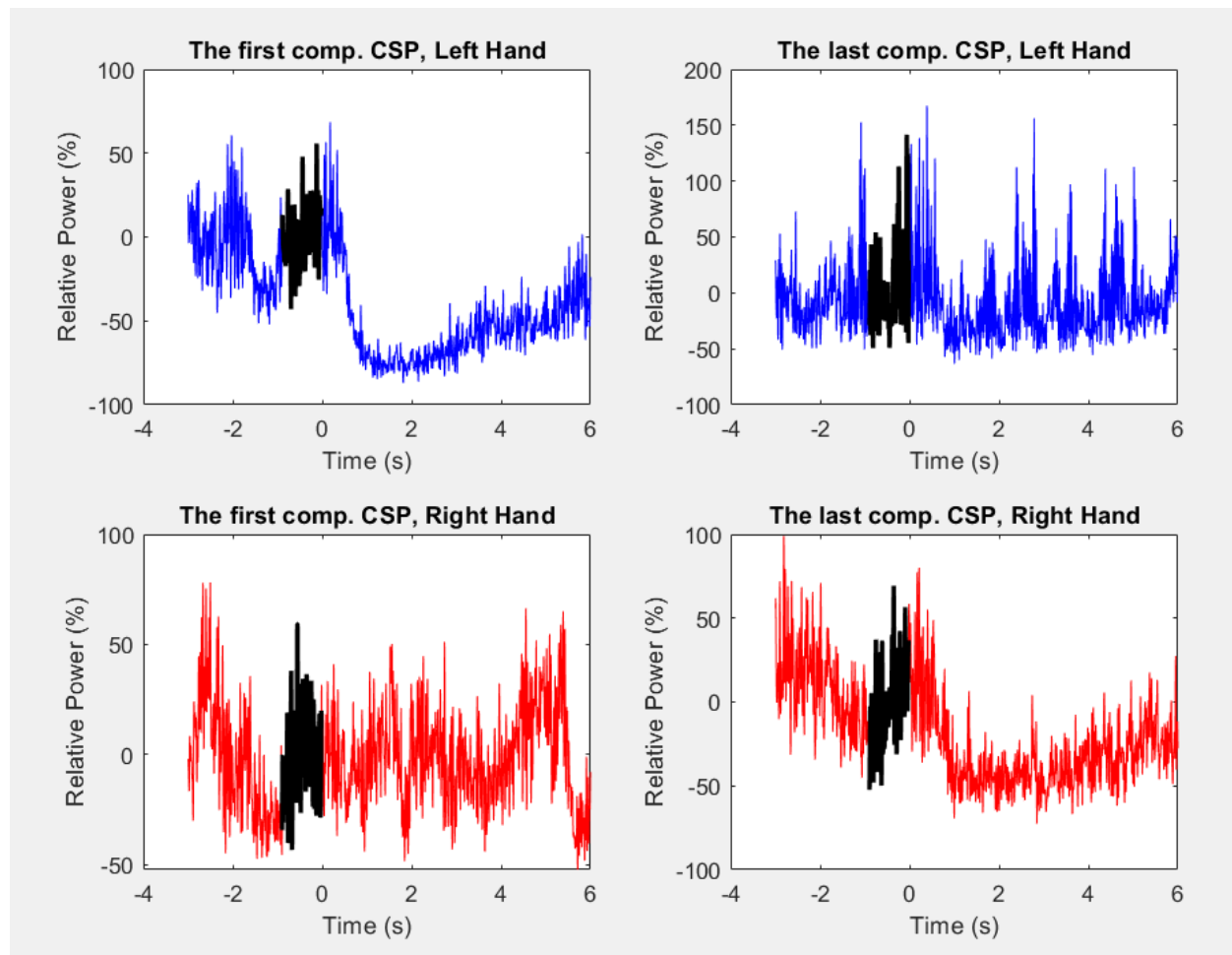
Similar observations can be made for the right hand task, where a decrease in power in the C3 electrode is observed after the baseline period because the electrode is contralateral to the right hand task (left side of the brain). Similarly, there is not a significant change in power for the C4 electrode that is ipsilateral to the task (right side is not involved).

Problem 2



Compared to problem 1, the SMR plots show cleaner trends and the same trends are observed due to contralateral activation of the brain which decreases power (ERD) after the baseline period (decrease in power after baseline in the C4 electrode when doing the left hand task and C3 electrode when doing the right hand task). This is because the large Laplacian filter attenuated the signal at the C3 and C4 electrodes and was able to reduce effects of surrounding sources that we are not interested in and ultimately increase source estimation quality for individual components.

Problem 3



CSP is a feature extraction method that uses spatial filters to maximize the discriminability (accentuates the differences) of two classes (left and right hand movements) around the C3 and C4 cortical areas when there are different spatial profiles (eigenvectors and covariances). **The first component of the CSP therefore has accentuated the spatial profiles for the left hand task and the last component has accentuated the spatial profiles for the right hand task.**

When comparing problems 1 and 2 similar trends are observed. The first two problems focussed on the C3 and C4 cortical areas whereas problem 3 looks at spatial profiles for each task. The first component CSP left hand plot shows the same trend as the C4 left hand plots in the first two problems. The last component CSP right hand plot shows the same trends as the C3 right hand plots in the first two problems. A more detailed explanation is provided below.

In the first component CSP, the left hand plot shows the signal after the first eigenvector of W has filtered out all spatial profiles except for the one linked to the left hand task. There is a decrease in power after the baseline period (ERD) which indicates that the subject is focused on

the left hand task due to contralateral brain activation. In the last component CSP, the left hand plot shows there is no significant change in power as the spatial profile associated with the right hand task is not activated during the concentration on the left hand task when the last eigenvector of W is used.

In the last component CSP, the right hand plot shows the signal after the last eigenvector of W has filtered out all the spatial profiles except for the one linked to the right hand task (therefore showing a decrease in power after baseline). Similar to the previous observation, when the first component is used for the right hand task there is no noticeable difference in power as the spatial profile associated with the left hand task is not activated when the subject is completing the right hand task.