BIM 280: HOMEWORK 4

Part 3: Plotting

	PC_1	PC_2
Event 1		
Event 2		
Event 3		

Soyuhos, Orhan – HW Week 4

| Event 4 | PSTH for event_4 and PC #1 | PSTH for event_4 and PC #2 |

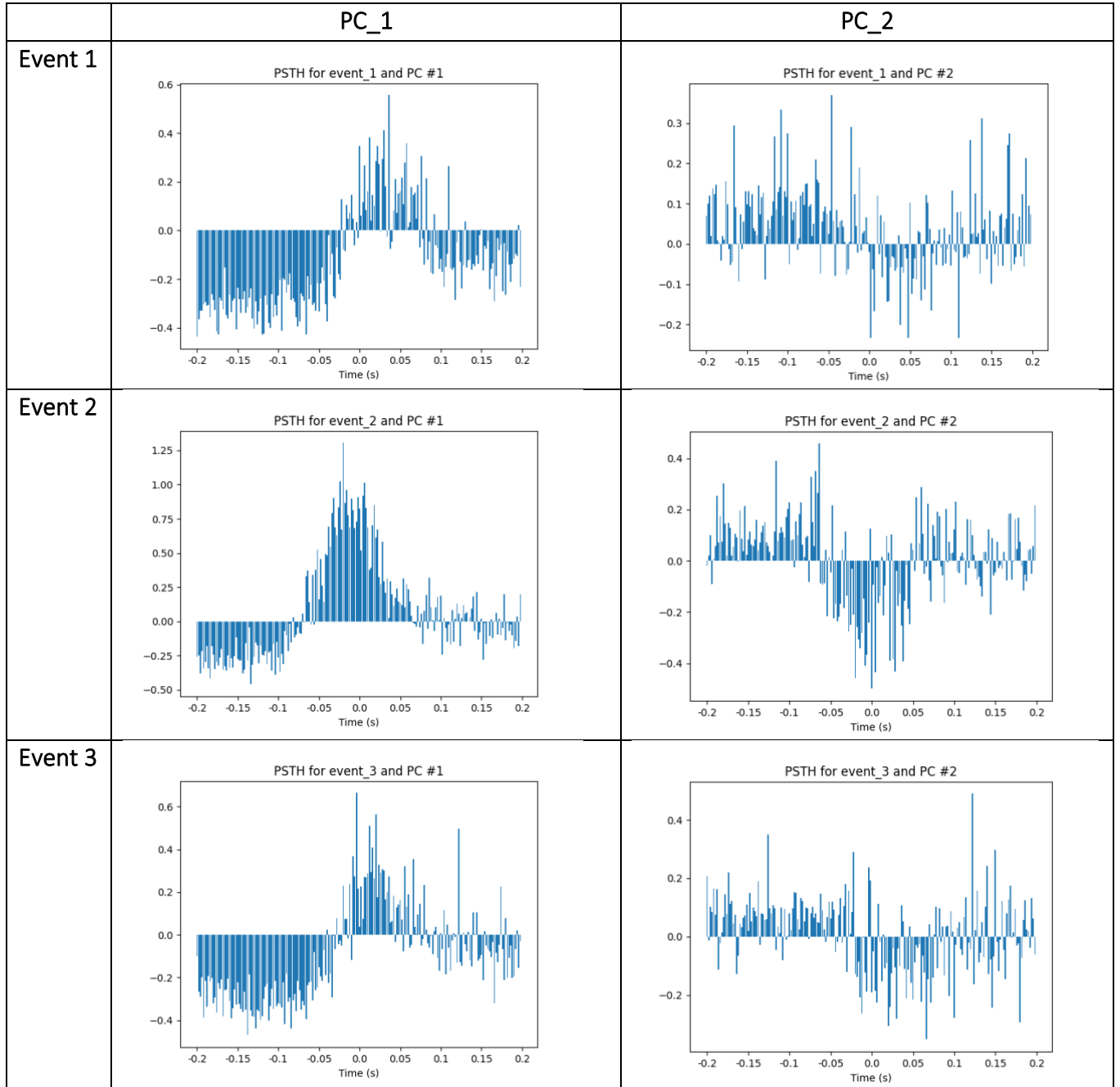|	PC_3	PC_4
Event 1	PSTH for event_1 and PC #3	PSTH for event_1 and PC #4
Event 2	PSTH for event_2 and PC #3	PSTH for event_2 and PC #4

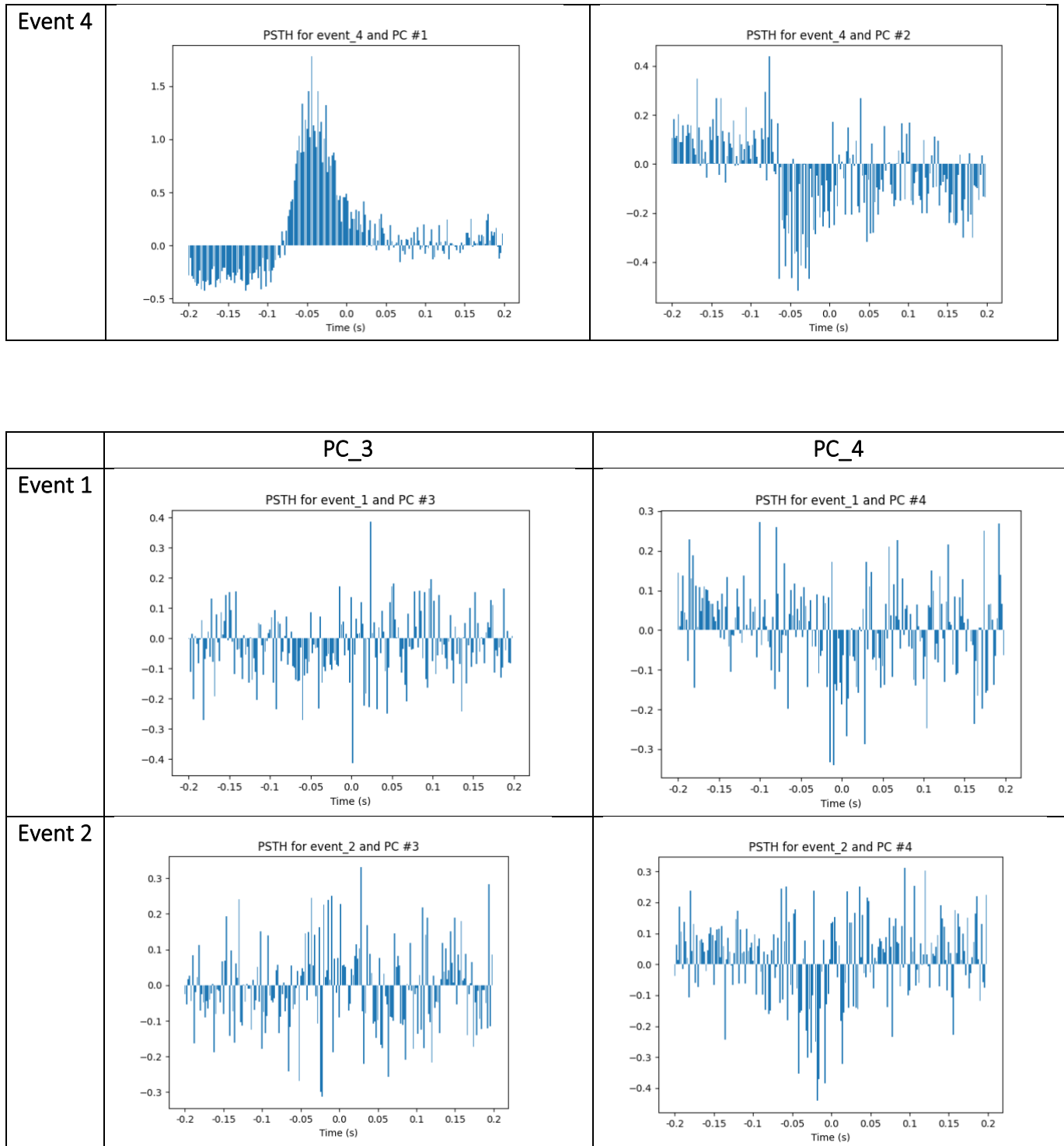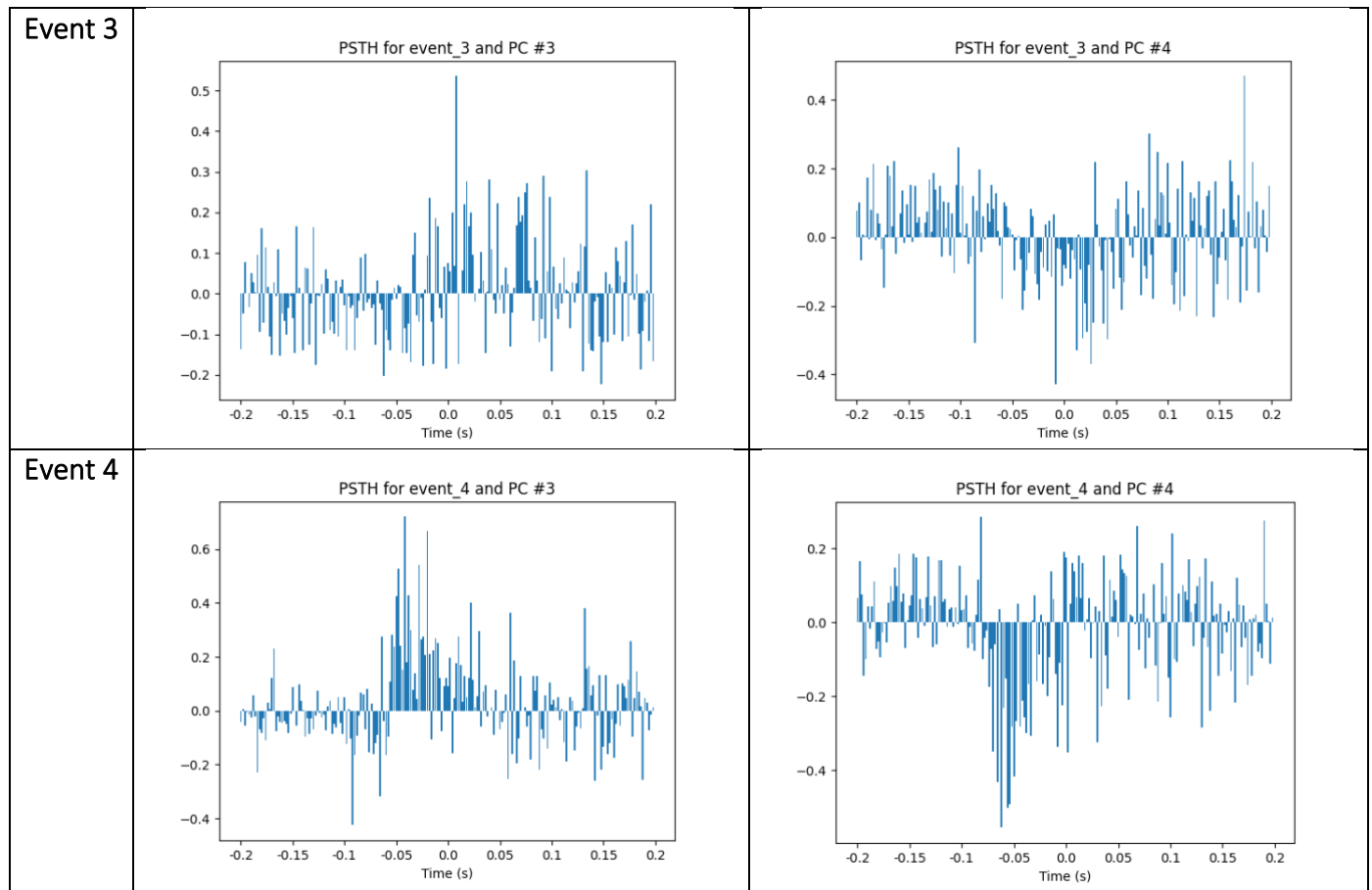| Event 3		
Event 4		

Part 5: Conceptual Questions

1. **Given that the performance using all principal components for the PSTH classifier was 50%, how does it compare to your performance using only four principal components. Explain.**

    When we use the first four principal components, the classifier's performance is 54%. The accuracy of our predictions is increased by 4%. Probably, it is because when we use all principal components, the classifier overfits. It takes into account principal components (e.g., n>4) that do not really explain the variance in the data. Therefore, it is not able to generalize the data which it did not encounter before. With the smaller number of principal components, the classifier only considers the most relevant information that is mostly likely generalizable across different recordings.

2. **How do you think changing the bin size after PCA before applying the PSTH based classifier would alter the results.**

With smaller bin sizes, we would have better temporal resolution to differentiate a group of neurons' response to events 1,2,3, or 4. However, this also would lead to higher variance in their PSTH representations. In return, the higher variance makes it harder for classifier to distinguish different classes and would lead to a decrease in performance. Whereas larger bin sizes results in a lower temporal resolution, but it also reduces the variance in the PSTH representation. In this way, it would improve the separability between classes and lead to better classifier performance.

3. **How do you think smoothing the data with a sliding moving average filter might affect the results of PCA?**

If we don't over-smooth the data, it might decrease the variance so that PCA can better capture underlying patterns (i.e., principal components) in the data. This might be particularly beneficial when we have small bin sizes. However, I would guess that if the data already has large bin size, a sliding moving average filter would worsen the results of PCA. The principal components would not be able to capture the general patterns in the data.

4. **Describe a more procedural way to find the ideal number of dimensions to use instead of arbitrarily picking some number (as was done with this assignment)). Explain why you think your procedure will result in either better or worse classification.**

We can look into the percentage of variance explained by each of the selected components. In our assignments this is the pc_variance. In the figure below, we can find the 'elbow' point. This is the point after which the increase in the number of components would not explain the variance as good as the points before. For example, it seems like we could have even only choose the first two components for analysis.