MATH 4397 Project 2

Data Provided by:
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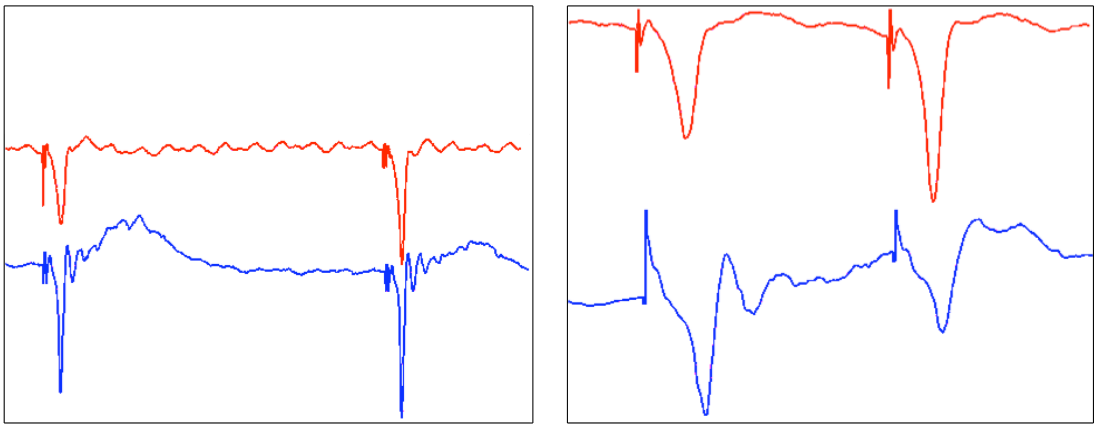
Note: Please include all your work, printouts of R code, etc, with your answer.

1 Introduction

In this project, we study the electrophysiological response of rat brain cells taken from the hippocampus region, to a stimulus consisting of two consecutive electrical pulses. Under normal or control condition, the response shows a facilitation, which means that the second pulse has a larger amplitude than the first. Under the convulsant condition (which is simulated by a drug called 4-AP), the response may show a depression of facilitation. A depression is characterized by a smaller amplitude of the second pulse as compared to that of the first. We use $P1$ to denote the amplitude of the first pulse and $P2$ to denote that of the second. In the control condition, the ratio $P2/P1$ is close to 1 only for a very few cases which correspond to experimental error. We want to test the hypothesis that the proportion of times this ratio is close to 1 in the convulsant case is the same as the proportion of times it is close to 1 in the control case. We want to see whether a ratio close to 1 occurs in the convulsant case as a matter of chance (due to experimental error), or whether the proportion of times this happens is significantly different from the proportion in the control condition.



(a) 10 Hz (b) 40 Hz

Figure 1: Paired pulse response under control (red) and convulsant (blue) conditions.

Table 1 lists the ratios $P2/P1$ for 12 independent experiments in each of the control and convulsant conditions for the 10 Hz case. **Any ratio in the range 0.85-1.15 is categorized as "no change" while a ratio < 0.85 or > 1.15 represents depression or facilitation and is categorized as "change".** Table 2 lists the same ratios for the 40 Hz case.

Control	1.83	1.73	2.04	2.22	2.08	2.18	1.14	1.52	1.42	1.53	1.39	1.51
Convulsant	1.29	1.24	1.27	1.23	1.07	1.12	1.06	1.2	1.01	1.18	1.04	1.07

Table 1: 10 Hz Data

Control	1.52	1.76	1.84	1.9	1.38	1.56	1.69	1.75	1.76	1.7	1.64	1.85
Convulsant	0.79	0.95	0.62	0.96	0.77	0.74	0.66	0.35	0.62	0.34	0.57	0.53

Table 2: 40 Hz Data

2 Hypothesis testing

1. For the data in Table 1, count the number of times when there is a change and the number of times when there is no change in each of the control and convulsant cases. List these values in the following contingency table:

	No Change	Change	Total
Control Convulsant			
Total			

   Also list the row and column marginal totals and the grand total.

2. Using the method appropriate for this kind of data test the hypothesis that the proportion of experiments for which a change occurs in the control case is the same as the proportion of experiments for which a change occurs in the convulsant case. Report the p-value. (Use R to do the hypothesis testing).

3. Repeat 1 and 2 for Table 2.

In which of the two cases (10Hz or 40Hz) can you conclude with at least 90% confidence that the proportions of times when we see a change are different for the control and convulsant conditions?