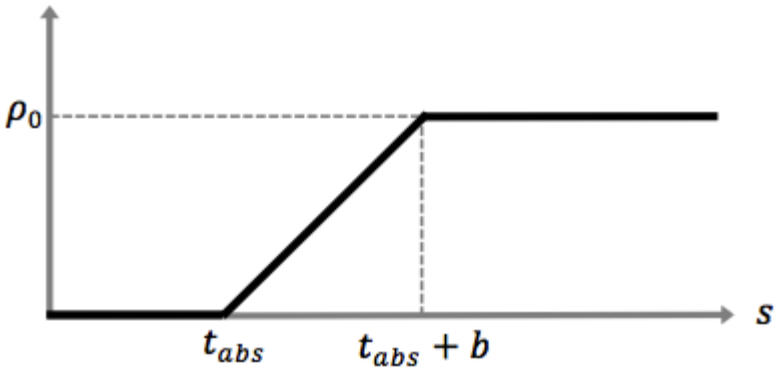
Homework 6.1: Relative refractoriness

Survivor Function

3/3 points (graded)

Consider a neuron with relative refractoriness. Given the last spike time $\hat{t}$, the probability of firing for $t \geq \hat{t}$ is given by $\rho\left(t-\hat{t}\right)$ where $\rho\left(s\right)$ is the hazard function defined for $s > 0$ in the following way.

$$\rho\left(s\right) = \begin{cases} 0 & \text{for } 0 <= s < t_{abs} \\ \frac{\rho_0}{b}(s - t_{abs}) & \text{for } t_{abs} <= s < t_{abs} + b \\ \rho_0 & \text{for } t_{abs} + b <= s \end{cases}$$



In the expression above, t_{abs} and b are just two fixed numbers. In fact the hazard function $\rho\left(s\right)$ is zero during the absolute refractory period $0 <= s < t_{abs}$ and it increases linearly up to maximum firing rate ρ_0.

Then, **survivor** function of such neuron for $t > \hat{t}$ is given by

$$S\left(t|\hat{t}\right) = \begin{cases} e^{-A} & \text{for } 0 <= t - \hat{t} < t_{abs} \\ e^{-B} & \text{for } t_{abs} <= t - \hat{t} < t_{abs} + b \\ e^{-C} & \text{for } t_{abs} + b <= t - \hat{t} \end{cases}$$

Indicate A, B and C:

A:

- 0
- 1
- $\rho_0^2(t - \hat{t} - t_{abs})^2$
- $\rho_0\left(t - \hat{t} - t_{abs}\right)$
- $\rho_0\left(-1 + t - \hat{t} - t_{abs}\right)$
- $\frac{\rho_0}{2b}(-1 + t - \hat{t} - t_{abs})^2$

✔

B:

- 1

- $\rho_0^2(t-\hat{t}\ -t_{abs})^2$
- $\frac{\rho_0}{b}(t-\hat{t}\ -t_{abs})$
- $\frac{\rho_0}{2b}(t-\hat{t}\ -t_{abs})^2$
- $\rho_0\ (-b+t-\hat{t}\ -t_{abs})$
- $\rho_0^2(-\frac{b}{2}+t-\hat{t}\ -t_{abs})^2$

✔

C:

- $\rho_0^2(t-\hat{t}\ -t_{abs})^2$
- $\frac{\rho_0}{2b}(t-\hat{t}\ -t_{abs})^2$
- $\frac{\rho_0}{b}(-b+t-\hat{t}\ -t_{abs})$
- $\rho_0\ (-\frac{b}{2}+t-\hat{t}\ -t_{abs})$
- $\rho_0\ (-b+t-\hat{t}\ -t_{abs})$
- $\rho_0\ (\frac{b}{2}+t-\hat{t}\ -t_{abs})$

✔

Submit You have used 1 of 1 attempt

✔ Correct (3/3 points)

Interval Distribution

3/3 points (graded)

For the neuron defined above, calculate the **interval distribution** function $P\left(t|\hat{t}\right)$. Then evaluate this function at the following indicated time values.

$P\left(t|\hat{t}\right)$ for $t=\hat{t}+\frac{1}{2}t_{abs}$ is equal to:

- 0
- 1
- $\rho_0 e^{-b\rho_0}$
- $\frac{\rho_0}{2}e^{-\frac{b\rho_0}{4}}$
- $\frac{b\rho_0}{2}$
- $2\rho_0 e^{-\frac{b\rho_0}{8}}$

✔

$P(t|\hat{t})$ for $t = \hat{t} + t_{abs} + \frac{b}{2}$ is equal to:

- 1
- $2\rho_0 e^{-\frac{b\rho_0}{4}}$
- $\rho_0 e^{-b\rho_0}$
- $\frac{\rho_0}{2} e^{-\frac{b\rho_0}{4}}$
- $\rho_0 e^{-\frac{b\rho_0}{4}}$
- $2\rho_0 e^{-\frac{b\rho_0}{8}}$
- $\frac{\rho_0}{2} e^{-\frac{b\rho_0}{8}}$ ✔

✔

$P(t|\hat{t})$ for $t = \hat{t} + t_{abs} + \frac{3b}{2}$ is equal to:

- $\rho_0 e^{-2b\rho_0}$
- $2\rho_0 e^{-\frac{b\rho_0}{4}}$
- $\rho_0 e^{-b\rho_0}$ ✔
- $\frac{\rho_0}{2} e^{-\frac{b\rho_0}{8}}$
- $\rho_0^2 e^{-\frac{b\rho_0}{4}}$
- $\rho_0 e^{-\frac{b\rho_0}{2}}$
- $e^{-\frac{b\rho_0}{2}}$

✔

Submit You have used 1 of 1 attempt

✔ Correct (3/3 points)

Discussion

Topic: Week 6 / Homework 6.1: Relative refractoriness

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