Package ‘pro’

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Type Package

Title Point-Process Response Model for Optogenetics

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Suggests cin

Description Optogenetics is a new tool to study neuronal circuits that have been genetically modified to allow stimulation by flashes of light. This package implements the methodological framework, Point-process Response model for Optogenetics (PRO), for analyzing data from these experiments. This method provides explicit nonlinear transformations to link the flash point-process with the spiking point-process. Such response functions can be used to provide important and interpretable scientific insights into the properties of the biophysical process that governs neural spiking in response to optogenetic stimulation.

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NeedsCompilation no

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Description


Usage

model.pro(spike, flash, fixed = NULL, kv = F)

Arguments

spike A binary vector represents spiking (1) or no spiking (0).
flash A binary vector of the same length of spike, 1 for flashing and 0 for non-flashing.
fixed Whether a fixed window of spike/flash history should be used. If it is NULL, a varying time window of history will be used as described in the reference. If it is a integer j, a fixed window from index t-j to t will be used.
kv Whether the history dependence model in Kass and Ventura (2001) (A Spike-Train Probability Model, Neural Computation 13, 1713-1720) should be employed. This differs from the history dependence model in the reference.

Value

a data.frame of the three response functions (PF, CF, SF) and other intermediate functions (for future modeling use).

Examples

n <- 500
set.seed(100)
re <- sim.lif(n, rbinom(n, 1, 0.14), 7, 3)
d <- model.pro(re$sbin, re$I)
d[1:10, ]
**pro**

*Fit the PRO model*

---

**Description**


**Usage**

`pro(spike, flash, ...)`

**Arguments**

- `spike`: A binary vector represents spiking (1) or no spiking (0).
- `flash`: A binary vector of the same length of `spike`, 1 for flashing and 0 for non-flashing.
- `...`: Additional parameters, see `model.pro`.

**Value**

A `glm` object of the fitted PRO coefficients.

**Examples**

```r
n <- 500
set.seed(100)
re <- sim.lif(n, rbinom(n, 1, 0.14), 7, 3)
fit.pro <- pro(re$sbin, re$i)
summary(fit.pro)
```

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**sim.lif**

*Simulate optogenetic stimulation on a leaky-integrate-fire neuron*

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**Description**

Simulate various kinds of neural measures (e.g. membrane potentials and spikes) from a LIF neuron.

**Usage**

`sim.lif(n, I, C, R, Vth = 1, V0 = 0, bin = 5, dt = 0.05)`
Arguments

n Number of time bins. The total time is n times bin.

I Input stimulus vector of length n.

C Membrane capacitance of the simulated neuron.

R Membrane resistance of the simulated neuron.

vth Membrane potential threshold for spiking.

v0 Membrane potential reset value after spiking.

bin Time length for each time bin. Default 5 millisecond.

dt Time length for each simulation step. Default 0.05 millisecond.

Value

a list of simulated neural spikes, optogenetic light flashes, and simulation parameters.

Examples

n<- 500
set.seed(100)
re <- sim.lif(n, rbinom(n, 1, 0.14), 7, 3)
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