LIF

%%Define parameters

Set the followings:

time step (all time units in ms)

length of simulation run

resting membrane potential (all voltages in mV)

voltage threshold

the voltage to draw a spike when a neuron spikes

excitatory/inhibitory reversal potentials

membrane resistance of excitatory and inhibitory synapses

membrane time constant

maximum conductivity of excitatory/inhibitory synapse

time constants of excitatory and inhibitory synapses

the time delay for action potential propagation across synapse

the time delay for action potential propagation down axon

frequency of spontaneous action potentials

calculate the number of spontaneous action potentials (it can be set separately for inhibitory and excitatory neurons)

the factor by which synapse conductivity decays per use

time constant for synaptic conductivity to recover

%%Retrieve .mat files containing the geometry and connectivity maps

retrieve connectivity matrices of before and after cut

retrieve synaptic strengths matrices of before and after cut

retrieve index of inhibitory and excitatory neurons

retrieve distance matrix

retrieve xyzzy-coordinates

%%Initial values and vectors

ask the user what condition the leaky-integrate-and-fire model to run for

Based on selection of either before or after cut hold the followings to run:

connectivity map

synaptic strength matrix

number of neurons

number of presynaptic and postsynaptic partners

index of inhibitory and excitatory neurons

%%Integrate the equation tau\*dv/dt = -V + E\_L + I\_e\*R\_m

set and sort the times of spontaneous APs for each neuron

for the simulation time run

for all neurons

zero the synaptic current

find all presynaptic connections to the neuron

for all the presynaptic connections

if presynaptic neuron is inhibitory(excitatory)

calculate the synaptic current

if an AP is traveling on the presynaptic axon

if the AP in queue has a timestamp = current time

fully activate the synapse (equal to the maximum conductivity)

synapse decay because of the activation

else

synaptic decay because of the synapse time constant

end

if synapse is still depressed

recover synaptic conductivity

end

if neuron is inhibitory(excitatory)

calculate neuron potential

if there is a spontaneous action potential for the neuron and its timestamp is equal to current time or neuron potential is greater than the threshold

set neuron potential to reset voltage

plot the spike

for all the postsynaptic partners of this neuron

calculate the AP delay based on distance and the axon delay constant

Pass AP time to postsynaptic neuron

end

end

end

end

end