**Removed Current direction multiplier and inhibitory connectivity**

If





**Removed Current direction multiplier, and excitatory + inhibitory connectivity**

* No change was observed

At this point I use the deterministic model to evaluate the synaptic inputs

|  |  |  |
| --- | --- | --- |
|  | **Neocortex Pyramidal Layer 2/3** | **Basket Neuron** |
| **Membrane Potential Rest (mV)** | -72.36 | -67.52 |
| **Membrane Potential Reset (mV)** | -80 | -80 |
| **Threshold Membrane Potential** | -41.40 | -40.25 |
| **Membrane Resistance (M Ohms)** | 160.47 | 152.7 |
| **Membrane Time Constant (ms)** | 19.73 | 9.57 |

for t=1:length(T)-1

Vs = sum(neuron.weight.matrix.\*S,2); % if previous bin spikes, S=1 applying a synaptic effect from that neuron.

% Determine Spiking

S = Vm > V\_th; % We determine whether the neuron spikes by crossing threshold

Vm(S == 1) = V\_reset(S == 1); %If a neuron spikes, the membrane potential Vs reset to the reset value

% Update membrane potential

Vm = Vm + Vs + dt .\* ( -(Vm - V\_e) + In + Im .\* Rm) ./ tau\_m;

end

****

**Single Pyramidal neuron with input 0.2165 nA = 20Hz**

****

**Single Neocortex Basket neuron with input 0.1991 nA = 40Hz**

The neuron needs current input to fire at all, that is how integrate and fire works! Question is now, how do we determine our baseline?

Should we determine spiking to be anything above threshold? (Any spike = neuron is activated) or should we assume a baseline FR?

For background noise (baseline), should current input be stable or randomized input that is somehow normally distributed?

Model Solutions with no synaptic connectivity (no inhibition or excitation)





**Model with only inhibitory inputs:**

One inhibitory synaptic input is roughly -3mV



Inhibition onto excitatory neurons seems to have a very minimal effect here in the deterministic model. AT LEAST, when it comes to finding if the neuron spiked AT ALL. If we were to look at firing rates, we should see a clear difference. I hypothesize inhibition would also be significant if we introduced a background noisy input.

Model with inhibitory and excitatory synapses:



Once again, I believe we may need to add noisy inputs?

Model with no synapses + steady 20hz and 40hz equivalent background input



Model with all synapses + steady 20hz and 40hz equivalent background input



Small rightward shift is present when compared to no synaptic input.