Research Migration Project

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Title :- **The NEUROSPIKE CIRCUIT**

The Neurospike Circuit is based on the Leaky-Integrate-and-Fire (LIF) neuron model, which is commonly used in Spiking Neural Networks (SNNs). Unlike traditional neural networks, SNNs communicate using spike trains. In this system, the timing between spikes carries information instead of relying on signal strength.

In the LIF model, input currents from several synapses pile up over time in a capacitor. This buildup raises the membrane potential ($\mathbf{V_m}$)of the neuron. At the same time, a controlled leakage reduces some of the charge, simulating the natural decay seen in biological neurons. When the potential hits a certain level, the neuron fires a spike and resets its voltage to a baseline value.

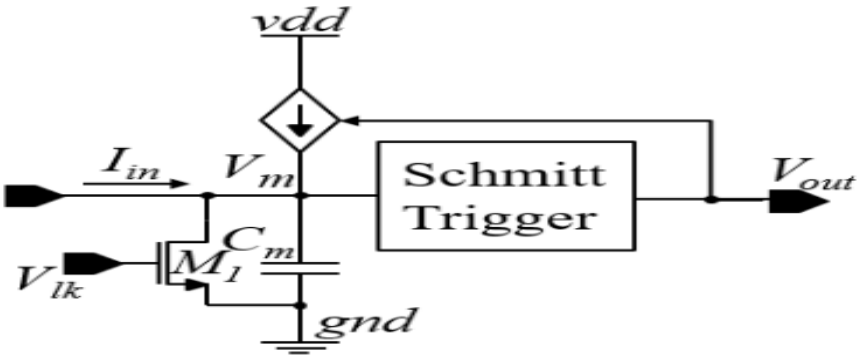

Figure 1 : **Leaky-Integrate-and-Fire**

Figure 1 shows **LIF** neuron model. Here, the input current $\mathbf{I_{in}}$ charges the membrane capacitor $\mathbf{C_m}$,which increases the membrane voltage $\mathbf{V_m}$. The leak transistor $\mathbf{M_1}$, controlled by $\mathbf{V_{lk}}$, represents the ongoing leakage of the membrane potential. When $\mathbf{V_m}$ reaches a certain threshold, the Schmitt trigger produces the output spike **Vo**. The Schmitt trigger also offers feedback to rapidly discharge $\mathbf{C_m}$, resetting $\mathbf{V_m}$ to $\mathbf{V_{reset}}$.

Reference :

[1] Analog Circuit Implementation of LIF and STDP Models for Spiking Neural