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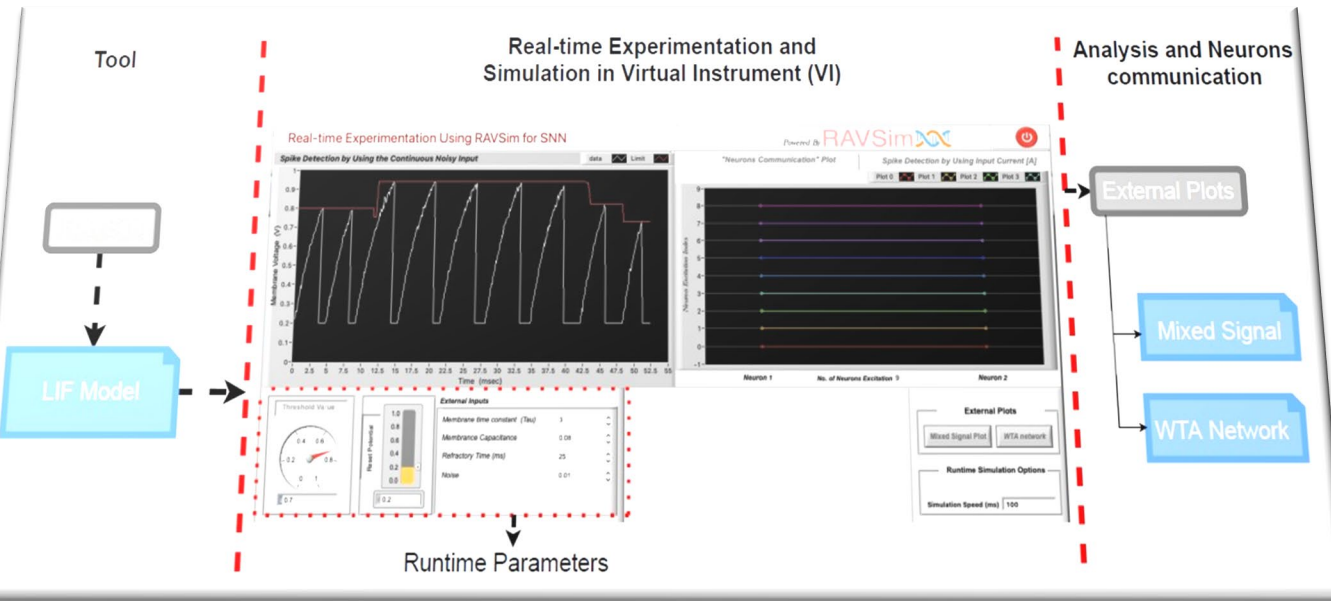
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Introduction

- Real-time Analyzing and Visualization Simulator or RAVSim is an interactive virtual experiment environment for the simulation and analysis of spiking neural network models.
- RAVSim tool uses Leaky Integration and Fire (LIF) model by using the continuous noisy input, spike detection by using input current, and generating a winner takes all network (WTA), which establishes communication between the neurons.
- Using the most complex model 'i != j's case, the simulator of RAVSim takes an average of ~12 seconds to analyzed and visualize the WTA network with 1000 neurons.

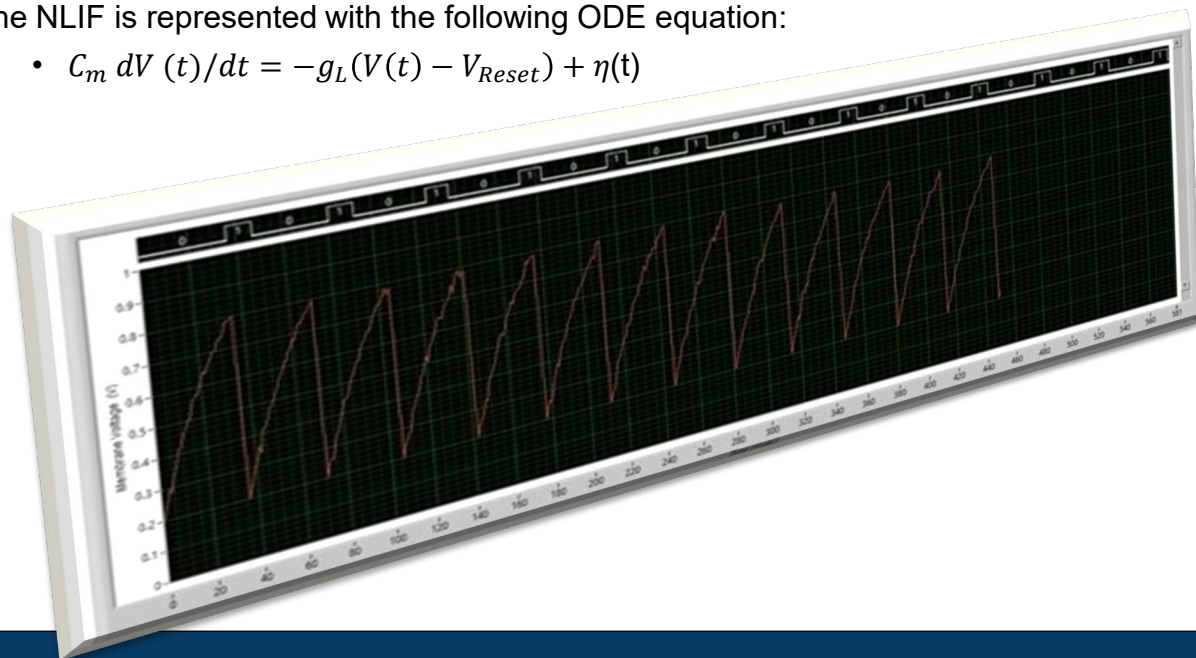
RAVSim v1.0

- "RAVSim" simulator is implemented using LabVIEW (Laboratory Virtual Instrument Engineering Workbench)
- RAVSim v1.0 was successfully published on LabVIEW's official website after being reviewed by their developer team.
- RAVSim provides a substitute for the time-consuming code-based experiments for analyzing and designing models with correct values and helps users to fully understand the SNN mechanism.



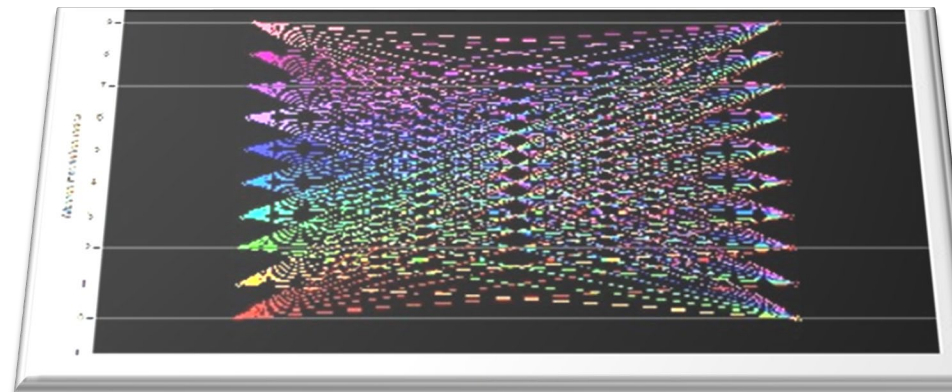
NLIF Neuronal Model

- In the proposed neural simulator, the simplified NLIF neuron model is utilized.
- The model is represented by an ordinary differential equation. It describes the sub-threshold dynamics of membrane and reset potential of a single neuron.
- The NLIF is represented with the following ODE equation:
 - $C_m \frac{dV(t)}{dt} = -g_L(V(t) - V_{Reset}) + \eta(t)$

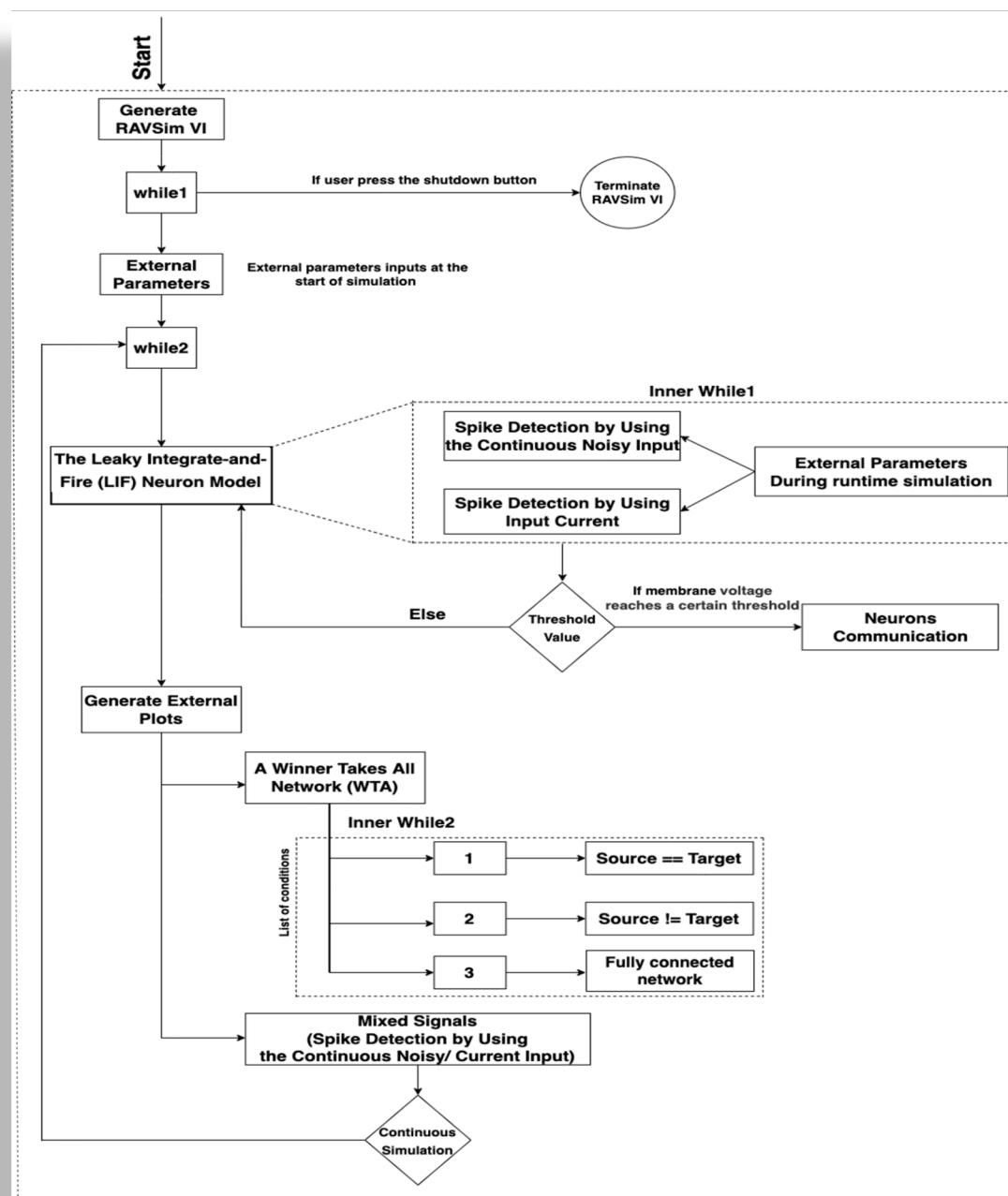


WTA Network

- The winner takes it all network or WTA network generally serves as a fundamental building block for many tasks involving neural networks, for example, learning, clustering, pattern recognition, and so on.
- We have implemented this in our interactive simulator RAVSim v1.0 in three types:
 - WTA with $i = j$
 - WTA with a fully connected network
 - WTA with $i \neq j$
- where 'i' is the source neuron index, and 'j' is the target neuron index.

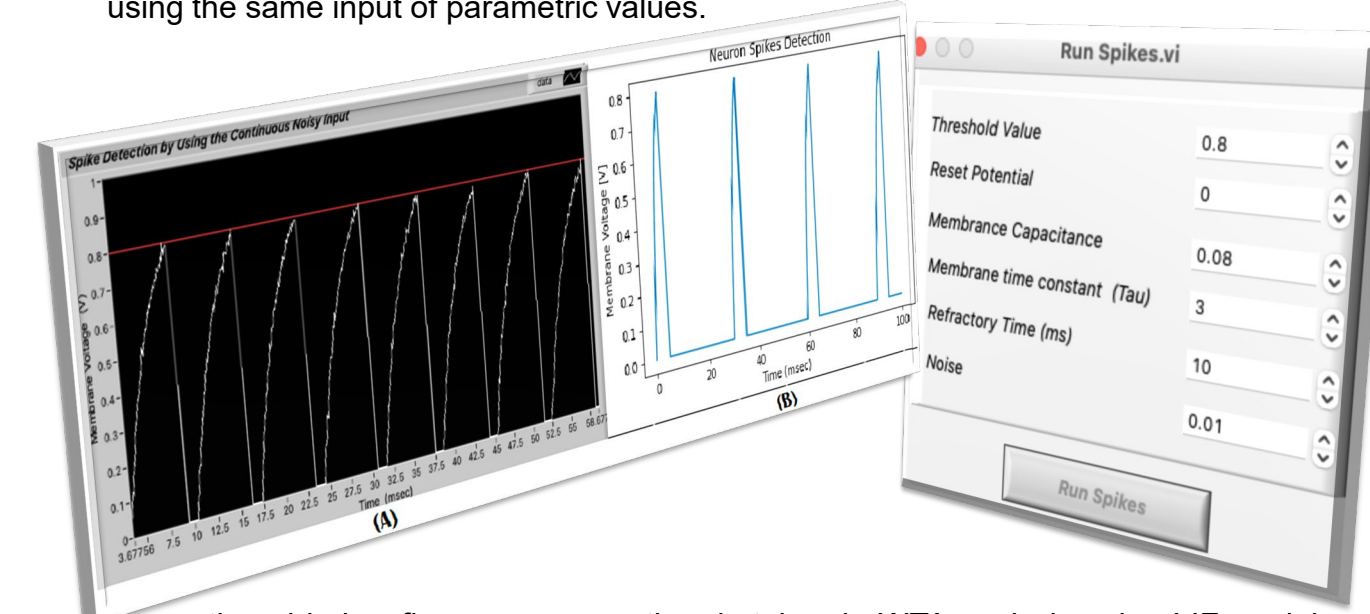


Data Flow Chart

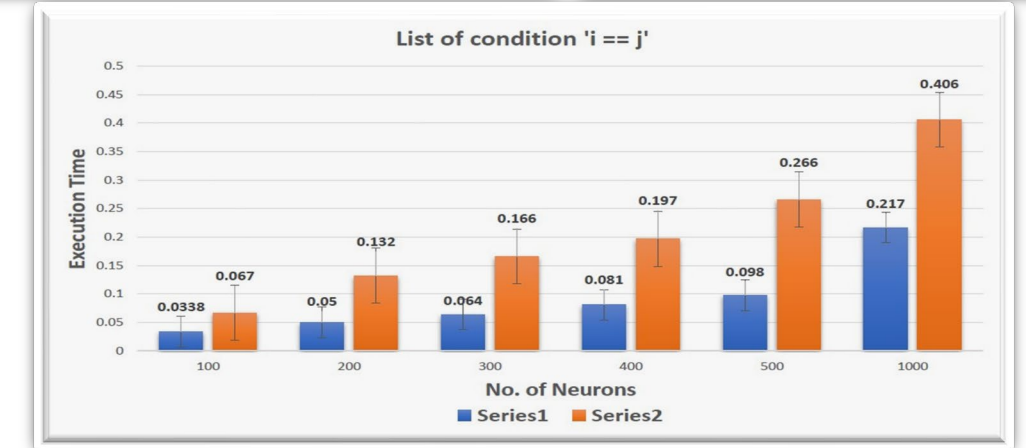
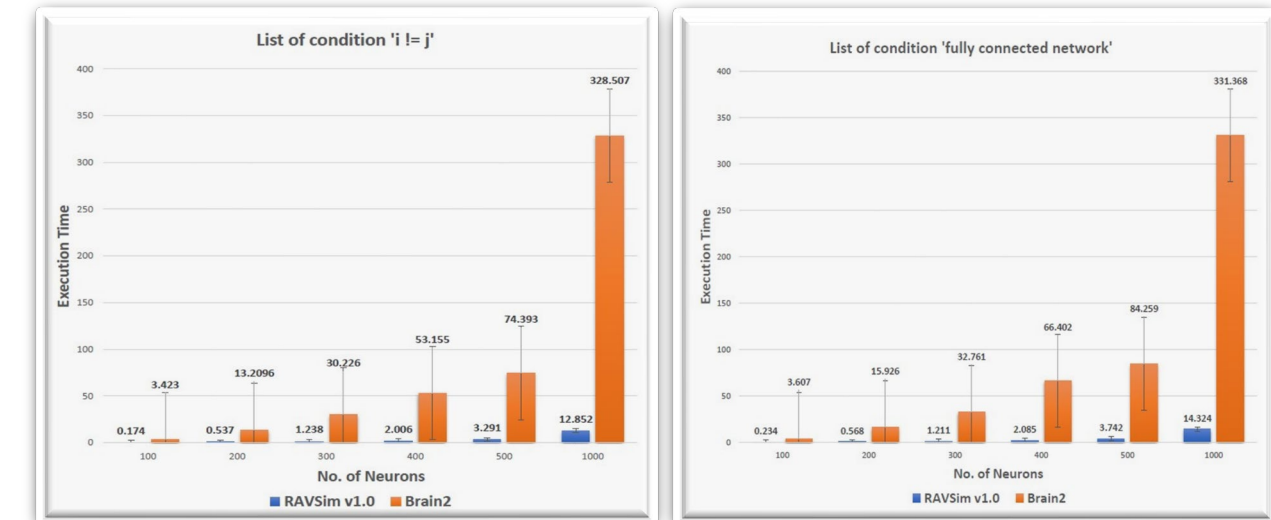


Experimental Results

- As you can see in Figure, the output of our RAVSim [A] and Brian2 [B] simulator by using the same input of parametric values.



- In mentioned below figures, average time is taken in WTA analysis using LIF model by the Brain2 and proposed RAVSim simulator for six test cases using different numbers of neurons (minimum 100 and maximum 1000 neurons), along with standard deviation error bars.



AVAILABILITY

- All of the experiments have been performed using real-time simulations on RAVSim v1.0.
- The RAVSim (v1.0) is an open-source simulator and it is available publicly at, [\[https://www.ni.com/de-de/support/downloads/tools-network/download.real-time-analysis-and-visualization-simulator-ravsim-.html#443936\]](https://www.ni.com/de-de/support/downloads/tools-network/download.real-time-analysis-and-visualization-simulator-ravsim-.html#443936)
- And video demonstration of RAVSim can be accessed at, [\[https://www.youtube.com/watch?v=Ozv0MXXj89Y\]](https://www.youtube.com/watch?v=Ozv0MXXj89Y)