

Investigation of Memristor-Based Neural Networks On Pattern Recognition

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Introduction

- ✓ It is the concatenation of a “Memory resistor”, which is a fourth fundamental circuit element besides resistor, capacitor, and inductor.
- ✓ This missing pair link states the relationship between charge and flux over four basic circuit variables and it is first coined by Professor Leon Chua.
- ✓ Depending on the type of input signal there are divided into two types current-controlled and voltage-controlled memristors

Ionic Floating gate model

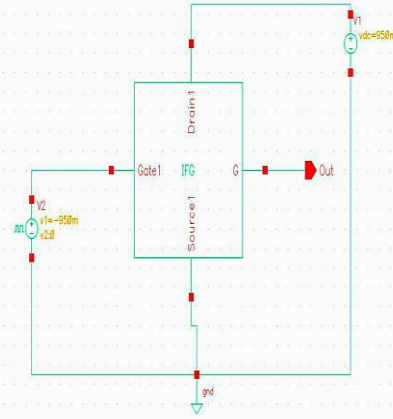


Fig 1. IFG model

Memristor-based neural networks

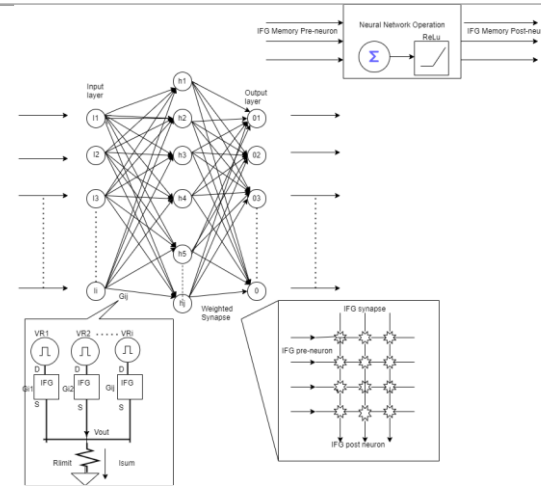


Fig 2. Fully connected ANN

Other results

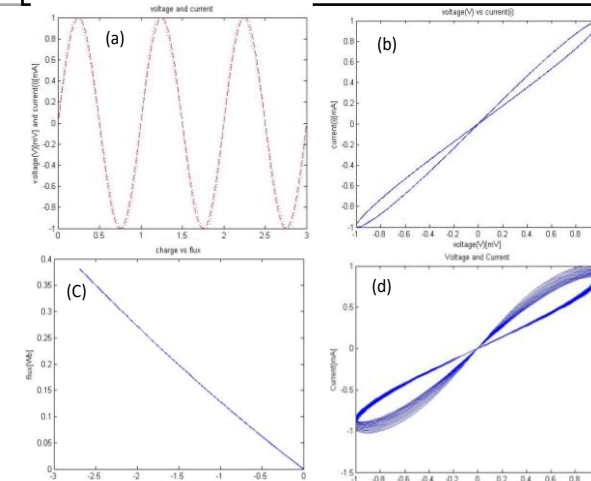


Fig 4. simulation results

Objective

- ❖ To recognize images by their front view and side view using memristor characteristics and deep learning.
- ❖ To increase accuracy we use deep learning algorithms along with MNIST picture pixels.
- ❖ To avoid vanishing gradients by the sigmoid function use the ReLU function in the gradient descent algorithm

Results and discussions

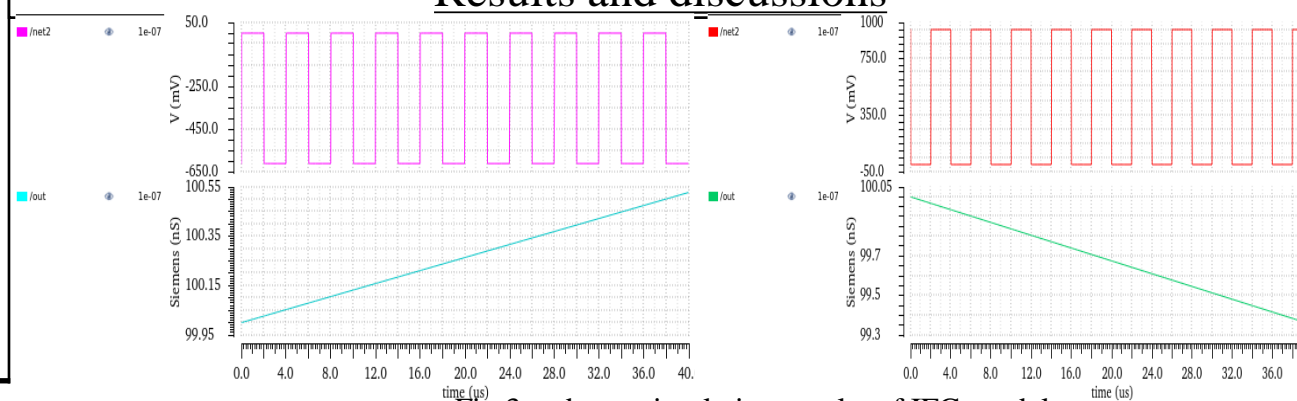


Fig 3 cadence simulation results of IFG model

References

- [1] Creswell, “UC Santa Cruz UC Santa Cruz Electronic Theses and Dissertations Title,” 2020. [Online]. Available: <https://escholarship.org/uc/item/0jx2107r>
- [2] Dindha Amelia, “Application of memristive device arrays for pattern recognition-Title,” 2020. [Online]. Available: <http://mpoc.org.my/malaysian-palm-oil-industry/>
- [3] W. Zhang *et al.*, “Hardware-Friendly Stochastic and Adaptive Learning in Memristor Convolutional Neural Networks,” vol. 2100041, 2021, doi:10.1002/aisy.202100041.

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