*PandaCite: A Python Based Enhanced Citation Manager*

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Abstract  
The modulation of synaptic transmission via artificial ion channels represents a frontier in neuroadaptive engineering. We report the design and simulation of a novel class of voltage-gated synthetic ion channels (VG-SICs) that dynamically alter conductance profiles based on predicted cognitive demand in silico. Using the RodentMind v2.5 simulation framework, we introduced VG-SICs into layer V pyramidal neurons and monitored performance across virtual maze navigation tasks. Panda et al. (2020)

Cognitive plasticity was assessed using adaptive learning rates derived from Hebbian feedback loops. Results demonstrated a 48% enhancement in task acquisition speed compared to control networks (p < 0.001), with VG-SIC activity correlated to theta phase locking. Sahoo et al. (2021)

These findings were further supported by gradient-based interpretability analyses which revealed upregulation of metaplastic subnetworks during critical learning windows. Grant et al. (2025)

Interestingly, long-term simulation revealed emergent oscillatory phenomena consistent with biologically observed sharp-wave ripples, suggesting partial biorealism. While hardware deployment remains a challenge, the proposed VG-SIC system paves the way for neuromorphic co-processors that flexibly adapt to real-time cognitive loads. Zhu et al. (2022)

References

**References**

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