Subject: Internship Proposal

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Project details

Title	Investigation of bio-inspired learning rules for spiking neural networks

Detailed description: The internship takes place within the field of neuromorphic computing and computational neuroscience, at the intersection of machine learning and neuroscience. Spiking Neural Networks (SNNs) represent the third generation of artificial neural networks, characterized by their ability to process information through discrete spikes over time — closely resembling the behavior of biological neurons. Unlike traditional deep learning models, SNNs offer potential advantages in energy efficiency and temporal data processing, making them a promising direction for edge AI and neuromorphic hardware. The internship investigates bio-inspired learning rules as an alternative to backpropagation-based training, aiming to develop more biologically realistic and hardware-friendly training strategies.

Measurable Targets
- Implement and benchmark at least two or more bio-inspired learning rules (e.g., STDP, R-STDP,) on standard classification datasets such as MNIST or N-MNIST
- Achieve competitive accuracy metrics compared to supervised SNN baselines, tracking performance indicators such as accuracy (%), convergence speed (epochs), and spike rate
- Quantitatively evaluate energy efficiency by measuring synaptic operations (SynOps) and spike sparsity across different learning rules
- Produce a comparative analysis report documenting the trade-offs between biological plausibility, computational cost, and task performance

Tools & Technologies
- Simulation frameworks: Brian2 or NEST for SNN modeling and simulation
- Programming language: Python

Duration (month – max 12)	6 months
Duration (hours)	50 hours
Open positions	4

Internship Skills

Technical requirements: Machine Learning basics Neural Networks	
Other skills	