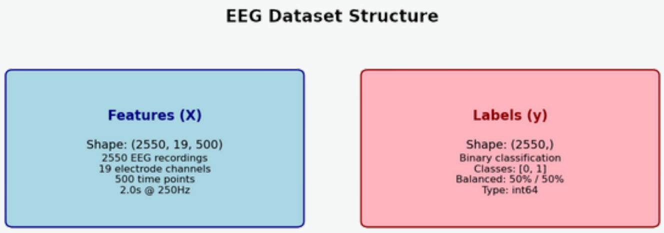
APPLICATION NOTE
SEPTEMBER 15, 2025

Platform Goal

Neuromorphic Computing combines neuroscience principles with electrical engineering hardware to create brain inspired processing architectures. While major corporations like Intel and IBM have developed neuromorphic technologies, alongside specialized companies like SynSense and Innatera, these solutions remain largely inaccessible to broader markets and applications. **Type 1 Compute addresses this gap by developing an accessible Neuromorphic Platform that delivers GPU level computational performance for critical infrastructure applications, eliminating dependency on cloud computing while achieving superior energy efficiency.** Our collaboration with ni2o demonstrates this platform's capabilities through their specific use case: optimizing Parkinson's disease detection from EEG datasets, where real time processing and energy efficiency are paramount for practical medical

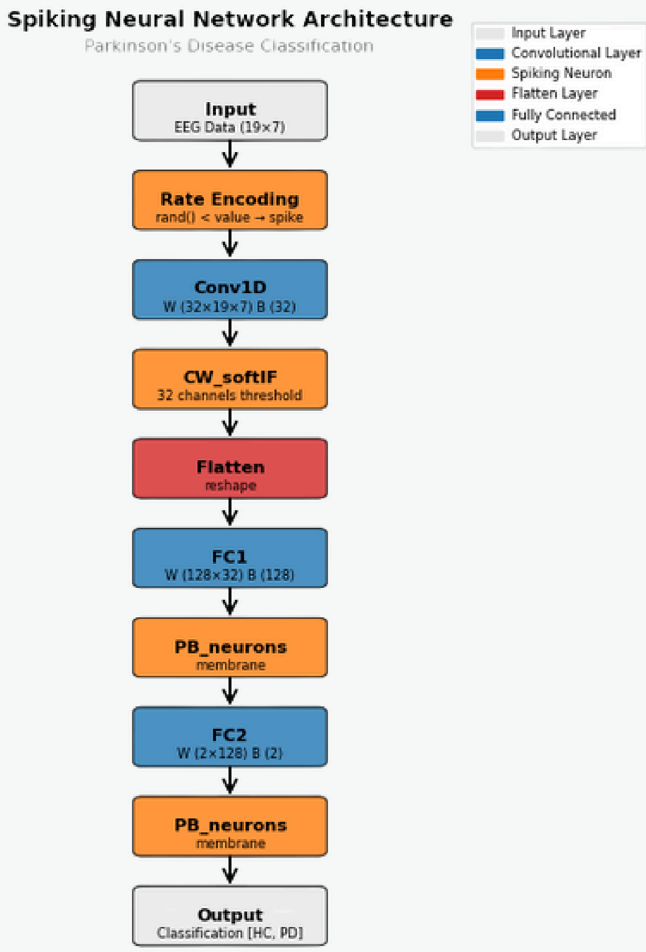
Use Case

ni2o is developing AI driven brain computer interfaces for the treatment of neurological disorders and cognitive enhancement. As they expand their infrastructure and prepare to scale, their primary challenge is ensuring that their computational models and machine learning algorithms operate with greater energy efficiency than GPUs can provide. Their main objective is to detect Parkinson’s disease and wanted a 90% or greater accuracy rate. **The primary motivation for adopting Type 1 Compute’s hardware architecture is its ability to deliver GPU level performance at the edge, enabling local deployment at a fraction of the energy cost and eliminating reliance on cloud computing.**



Architecture

For the SNN Architecture, we implement pure SNN Architecture for optimization. We prioritize 2550 EEG readings, 19 electrode channels, with 500 time points with 2 seconds at 250Hz as the inputs: resulting in the output being a Binary Classification Output with a 0 and 1 representing no and yes for Parkinson’s Disease prediction. In terms of the more in-depth architecture the architecture follows a deep learning structure with alternating convolutional and fully connected layers. It starts with a Conv1D layer, followed by a CW_softIF to convert continuous values into discrete. The network then progresses through a flattening operation and two sets of fully connected (FC) layers with PR neurons as activation functions after each of them. The final output provides classification results, distinguishing between healthy and Parkinson's Disease states based on the processed EEG patterns. The whole process is made through the Neural Architecture Search which makes transforming the Convolutional Neural Network into Spiking Neural Networks possible.



Results	
Device	Power Efficiency GOP/s/W
T1C Neuromorphic Hardware	64.57
NVIDIA Jetson Nano	16.67
NVIDIA RTX 3060 GPU	3.50
Intel i9-12900H CPU	0.64

Technical Performance

Compared to conventional CPUs and GPUs, our custom neuromorphic hardware demonstrated remarkable energy efficiency, being over 100 times more efficient than a CPU and nearly 20 times more efficient than a GPU. Specifically, **our AMD Artix™ US+ XCAU15P FPGA achieved 64.57 GOP/s/W,** substantially outperforming the **Intel i9-12900H CPU** at **0.64 GOP/s/W** and the **NVIDIA RTX 3060 GPU at 3.50 GOP/s/W**. When benchmarked against embedded solutions, our FPGA implementation maintained its superiority with approximately 4 times better energy efficiency than the **NVIDIA Jetson Nano embedded GPU (16.67 GOP/s/W**). This positions our ni2o model implementation as an optimal solution for energy constrained applications where computational efficiency is paramount.
This exceptional energy efficiency, combined with our successful 90% accuracy rate for Parkinson's disease detection, positions our ni2o model implementation as an optimal solution for energy constrained medical applications where computational efficiency is paramount. **The ability to deliver this level of performance at just 0.516W total power consumption** enables true edge deployment for real time EEG analysis without dependency on cloud infrastructure, directly addressing ni2o's core requirements for scalable, efficient neurological disorder detection.

Roadmap

Building on our initial tests, we are focusing on collaborations (starting with ni2o) on board and harmonize partner EEG and BCI data. We will scale up NAS to convert multiple baseline models (CNNs/Transformers) into optimized SNNs, selecting Pareto-optimal architectures that balance accuracy, energy, and latency. The top SNNs will be validated for cross site generalization and then deployed on our hardware stack, delivering ni2o a reproducible path to ultra-low power, realtime EEG inference and a template for future BCI partner deployments.

hello@type1compute.com

503.810.8092

www.type1compute.com