CNN Models Comparison for Seizure Detection

Model Type	Parameters	Key Pros	Key Cons	FPGA Suitability	Recommended Use Case
Lightweight 1D CNN	10,000–20,000	- Extremely lightweight - Fast inference - Good for local pattern capture	- May struggle with complex seizure patterns - Limited spatial relationship learning	Excellent (small FPGAs like Artix-7)	Start with small FPGAs or new to CNN-FPGA integration
Multi-Channel 1D CNN	50,000–100,000	- Processes channels independently - Captures channel-specific features	- Higher resource demand - May miss cross-channel correlations	Good (mid-sized FPGAs like Spartan-7)	Improved accuracy with moderate FPGA resources
2D CNN with Channel-Time Representation	100,000–200,000	- Captures spatial and temporal patterns - Effective in EEG classification	- Computationally intensive - Requires more FPGA resources	Feasible on larger FPGAs (Kintex-7)	Prioritize accuracy with larger FPGA
Temporal Convolutional Network (TCN)	50,000–150,000	- Captures long-term EEG dependencies - Easier to parallelize than RNNs	- Slightly complex - Dilation logic can complicate implementation	Good for mid-to-large FPGAs	Seizures with prolonged pre-ictal patterns
Pre-Trained Model (EEGNet)	20,000–50,000	- Compact, EEG-specific design - Low parameter count - Widely validated	- Requires dataset tuning - Depthwise ops can be tricky	Excellent (low parameter, optimized for EEG)	Proven, efficient model with good accuracy