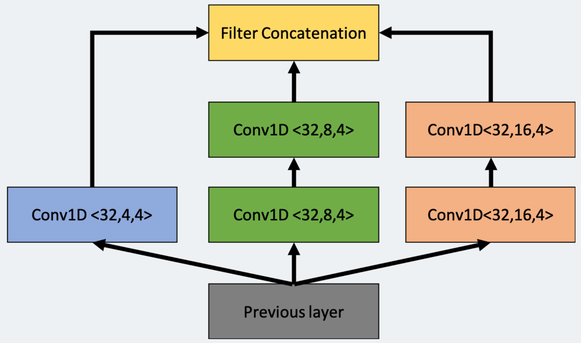
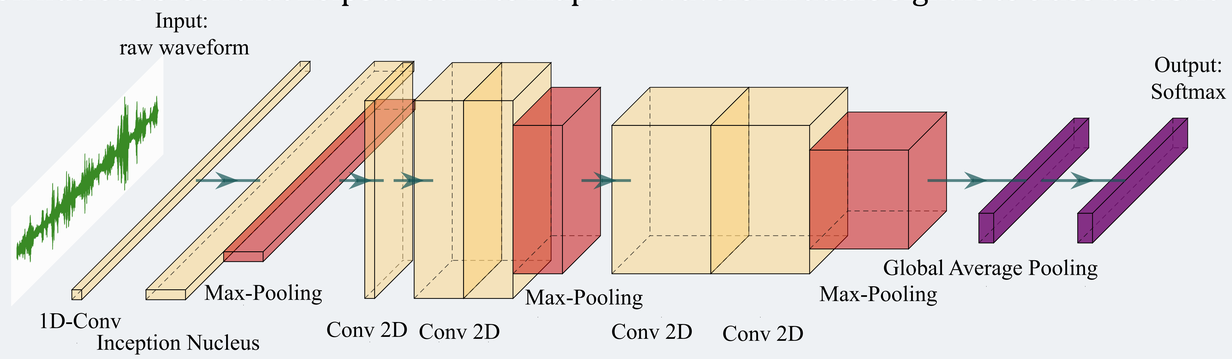
Toward Real Time Very Low Power Sound Recognition Using Neuromorphic Hardware

Why Neuromorphic? Because this hardware is very efficient in energy consumption and very small to fit in small gadgets like cell phones and tablets. It saves battery!

Designing the ANN Model and Training

Previously our research scientists proposed an inception nucleus block that helps to learn to map raw waveform audio signals to class labels. It also enables the model to learn richer features.





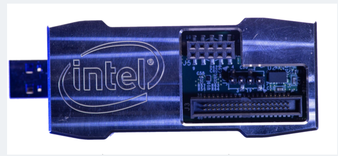
Translating ANN to Spiking Neural Networks (SNN)

Compiling the SNN and Map to Kapoho Bay

Running the Model for Inference

Use Cases of Sound Classification on Neuromprphic Chip:

What is Kapoho Bay?



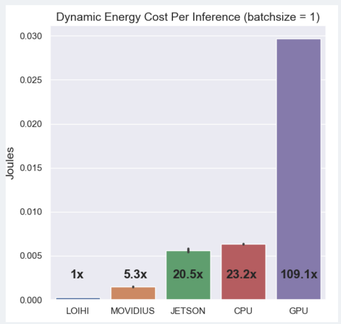
Kapoho Bay is a USB stick form factor that incorporates 2 Loihi chips.
With 2 chip Kapoho Bay has 256 neuromorphic cores with 262,144 neurons and 260,000,000 synapses.

Converting ANN to SNN Involved 4 Key Network Architecture Adaptations:

- Max Pooling → Average Pooling
- Input Dimensions 32K → Input Dimensions 8K
- GAP → Flatten + Dense
- Total Parameters 292K → Total Parameters 143K

Generating the Network Architecture with NxSDK → Loading Quantized Weights → Compiling the Network

Energy consumption of the Loihi is less than 0.01x the energy consumed by a typical Titan GPU.



Hardware	Idle (W)	Running (W)	Dynamic (W)	Inf/Sec	Joules/Inf
GPU	14.97	37.83	22.86	770.39	0.0298
CPU	17.01	28.48	11.47	1813.63	0.0063
Jetson	2.64	4.98	2.34	419	0.0056
Movidius	0.210	0.647	0.437	300	0.0015
Loihi	0.029	0.110	0.081	296	0.00027

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