

HEARING ASSISTANCE

TINY AI APPLICATION EXAMPLE

Voice as a management function has tremendous potential. It includes voice activation when the system awakes upon voice detection, keyword spotting when commands could manage the system, and other features in the event our hands are busy.

All those features stand to benefit from artificial intelligence, especially from a neural network paradigm, since the voice is typically delivered along with many other sounds from the ambient environment. But practical implementation of mathematical AI methods is challenged by excess power consumption when performed in a traditional way on standard CPUs.

Refining the ability to hear the human voice in noisy environments would be a major step forward for hearing aids, two-way radios, gaming, and other applications.

Voice extraction is the major challenge for many applications since the problem ideally needs to be solved in the miniature device and not in the cloud. A neural network is the answer, once embedded in a small, lowpower, and low-latency chip.

POLYN Technology can do that. POLYN's NASP approach, with neural networks in specialized hardware with extremely low power consumption and low latency, is the ideal approach. The tiny POLYN chip is intended for battery powered electronics, such as hearing aids or other earbuds.

For devices performing always-on processing, the **Neuromorphic Analog Signal Processing (NASP)** solution offers ultra-low 100 μ W power consumption and at least 15% higher accuracy than traditional algorithms.

To provide flexibility, **NASP** uses a hybrid model, combining a fixed part of the neural network (with analog weights) with a flexible part in digital to enable classification and interpretation, for example, with keyword spotting commands that require tuning for different languages or for different tasks.

Neural networks perform voice processing very well, including learning phoneme probability from highly parallel audio inputs (Markov models can use phoneme observation probabilities that neural networks provide to produce the likeliest phoneme sequence or word) and voice activation, detection, and voice extraction.

Benefits of Neural Networks for Hearing Assistance

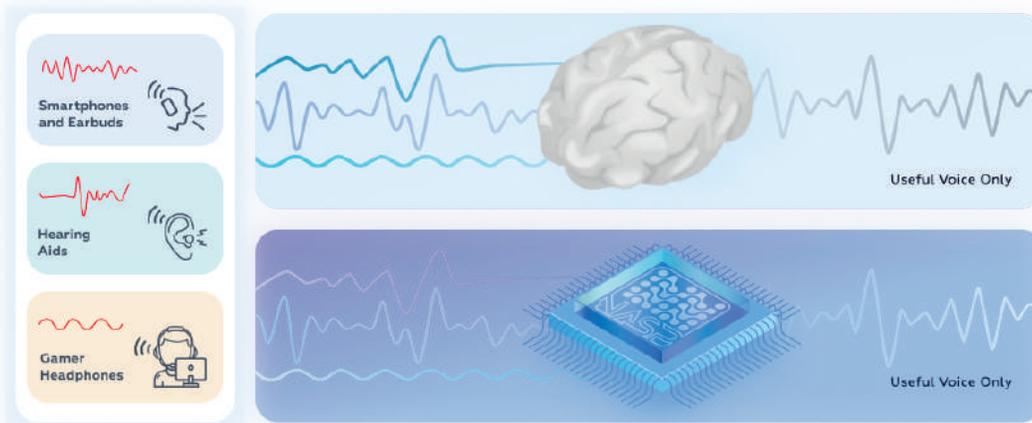
- A neural network is flexible for one-dimensional signal processes like authentication, voice extraction, command detection.
- Neural networks are stable in tasks involving many complex inputs and fusions of different models. Once trained, they do not fail and deliver high reliability.

Human voice extraction out of ambient sounds can enable clean and clear speech for hearing aids, conference calls, or any other situation where clarity is important. This solves a real problem for the hearing impaired, allowing them to hear a voice free of background and ambient noise.

It also enhances the audio experience for gamers and first responders using two-way radios. At the same time, when there is no voice (so-called silence), there is a need to continue transferring ambient sounds through a hearing aid. Such noises (music, radio, etc.) should be transmitted without suppression.

HOW IT WORKS

POLYN’s NASP Voice Extraction solution combines two blocks and two functions. It contains Voice Activity Detection to signal the presence or absence of voice in the sound and Voice Extraction to efficiently enhance voice, suppressing accompanying noise but only when required. Voice Activity Detection is used in two modes. When there is a voice, it activates voice enhancement and extraction. When there is no voice, the signal from the input microphone bypasses voice enhancement and goes directly to the device.



THE IMPORTANCE OF NASP

NASP technology provides the optimal answer for applications such as voice extraction, highlighting the potential of the technology for IoT sensory systems to understand special requirements. With 100µW power requirements and 10µs latency, it addresses miniature designs with small batteries and opens opportunities for new applications.

The NASP chip enables a combination of several networks, creating the lowest power system covering Voice Detection with Voice Recognition and Voice Extraction, or Keyword Spotting instead.

It is perfect for both voice management systems and hearing aids solutions. More than that, you can create your own combination and order, adding an additional level of customization on top.

WHY POLYN?

Our unique NASP technology has a brain-mimicking architecture for handling raw sensor data of various types of signals. Moreover, POLYN offers a novel approach to analog integrated circuits aiming to imitate the human brain processing in a truly neuromorphic solution. The NASP solution is hybrid; it includes a fixed neural network that doesn't change after a certain number of training epochs along with a flexible one capable of changing the last few layers according to the transfer learning approach.

POLYN supports the fast and cost-effective development of tailored solutions that perform deep learning computations on mass-market devices targeted for always-on, low power, and fast inference. POLYN's additional services cover neural network selection, optimization (pruning), and generation of the SW simulation (D-MVP) for the resulting neural network prior to the silicon production, guaranteeing 100% fit of the resulting analog chip.

