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Enhancing human auditory function with artificial intelligence

We don’t hear with our ears; rather, neuroscience shows that the peripheral auditory system serves as sensors that perform the important functions of directionality, tonotopic frequency analysis, nonlinear amplification, and transduction of sound into a neural impulse train that is transmitted via the auditory nerve fibres to the brain. The cerebral cortex of the healthy human brain processes and recognises these sounds, suppresses noise, and helps us understand speech. This computation is performed by a dense network of billions of neurons within the auditory cortex and beyond. Our brain loses this remarkable ability, however, when we live with untreated hearing loss, which can result in brain atrophy. Artificial intelligence (AI), including rule-based machine-learning algorithms, has been used in hearing aids for the past decade to improve speech understanding via environment classification. Recent advances in computation hardware and memory capacity have facilitated new AI applications, including deep neural network (DNN) architectures, for processing and enhancing sound. This session will focus on AI and DNN, specifically how new features based on these technologies are implemented in hearing aids for potential patient benefits.

Specifically, we will present a new sound processing system that mimics the cortical computation with a power-efficient hardware-accelerated DNN architecture embedded within the processor chip of a hearing aid device, and the results obtained for speech enhancement in various listening situations. We will also present the incorporation of an intuitive user interface to guide the AI processing scheme with listener intents based on context.